

hp·ux/usr

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The X Window
System and
HP-UX/NT
Interoperability

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HP ORACLE UNIX

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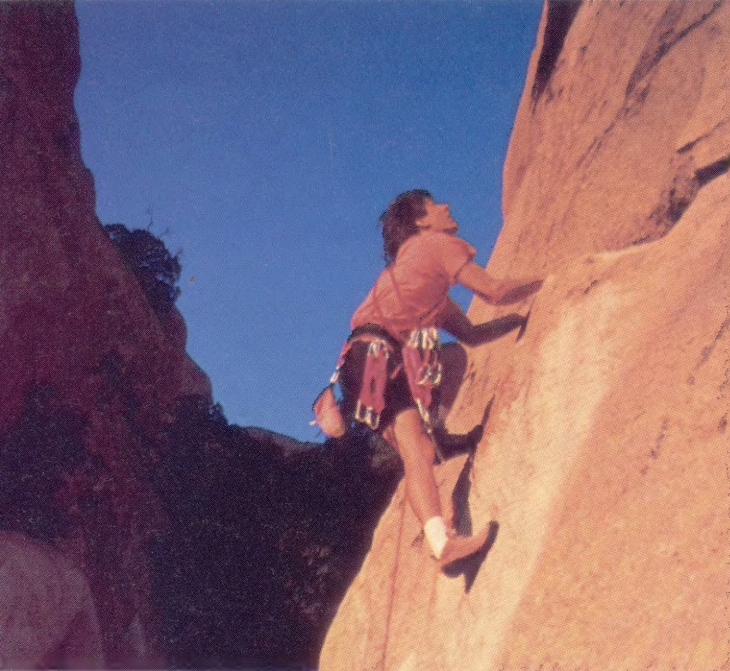
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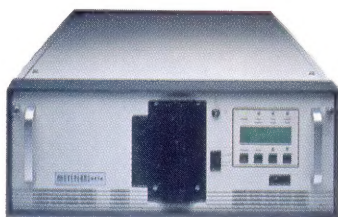
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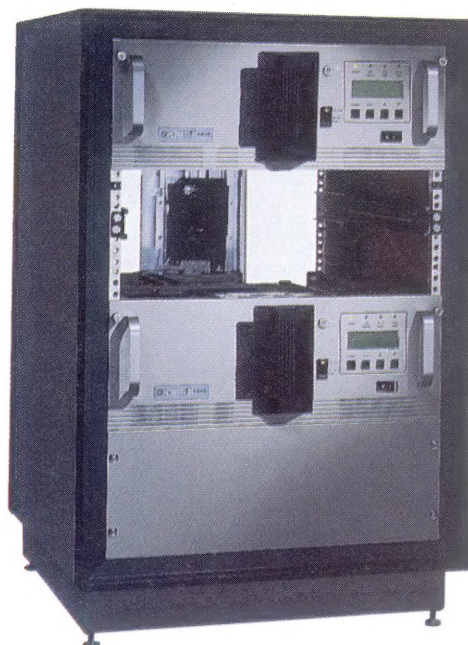
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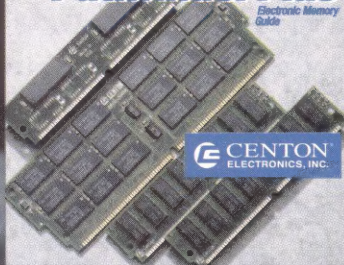
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Features

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The X Window System and HP-UX/NT Interoperability

If, like many, your organization is integrating NT workstations and servers with HP-UX systems, you'll want to read the series of features on interoperability in hp-ux/usr. We start off this month with a look at running X Windows on NT.

Marty Poniatowski

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Security Concepts: The Questions You Should Ask Yourself

You know you should be serious about security, but just how important is security in your organization? This article provides a checklist of key questions about security for the manager, system administrator, and end user.

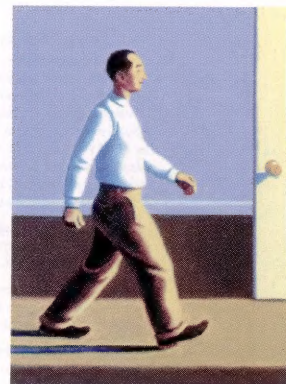
John A. Pezzano

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Coffee Talk: Going From C++ to Java

If you've been on another planet, you may have missed the excitement in the Internet programming community surrounding the release of the first Java Development Kit. If, on the other hand, you're a C++ programmer looking at the Java technology as a way of programming for the Internet, read this article—it's full of examples that will help the C++ programmer get started in Java.

Frederick F. Chew



New Products 12

Cover Illustration by Karen Tokmakoff

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CIRCLE 163 ON READER SERVICE CARD



Editor's Notes

Spring has sprung, more or less, and activities here at the Interex office pick up as we head into the conference season. The InterWorks conference in Philadelphia is only a couple of weeks away as this issue goes to press. HP World '97 will have a strong HP-UX track—the list on the opposite pages gives you an idea of just some of the more than 120 HP-UX sessions you can attend at the August 24-28 conference in Chicago.

FAST (Freely Available Software Technology) is a very exciting project under way now. InterWorks and Interex have been working together to deliver packages that bundle functional software that is useful for end users and easy to install and maintain for system administrators. The first package bundles the top 100 packages from the user community, ported to HP-UX 10.x. Be sure to read Paul Gerwitz's CSL Perspective for more information on FAST.

As I write this, Sun Microsystems is preparing to unveil new features of Java that will make the language more appealing to those who depend on servers and computer networks. If you have been coding in C and C++ and are thinking of giving Java a try, you'll want to read Fred Chew's article on Java programming for the C++ savvy. There are plenty of similarities and the shift should be easy, but you need to remain alert to certain key differences in style and syntax.

Sys admin expert Marty Poniatowski is doing a series of articles on NT and HP-UX interoperability. Microsoft has been touting NT as a server OS and certainly we are seeing more and more NT machines mixing with HP-UX systems. Marty starts off by showing how you can get the X Window System up and running on the NT box, integrating the NT workstation with the HP-UX system so you can take full advantage of the two systems working in concert.

This issue's cover feature is from data comm and security specialist John Pezzano. He has had a lot of experience in the security arena. His article is a full check list of questions about security—things end users, managers, and system administrators should ask themselves about security in their organizations. We all know how important security is, but how seriously do we take it? John's article provides a sharp focus on this critical issue.

M. M. Ehrhardt

Michael Ehrhardt
Managing Editor

KEEPING YOU A STEP AHEAD



HP WORLD '97

August 24-28, 1997
Chicago ♦ Navy Pier

Get the HP-UX training and information you need to succeed.

A world of HP-UX solutions will be at the Chicago Navy Pier between August 24 and 28. If you're an HP-UX user, you'll get time-critical, hands-on information at a variety of skill levels. It's the largest and most comprehensive HP event of the year, so don't miss out. You'll gather big picture perspectives, detailed technical tips, and up-to-the-minute product information through:

- ▼ Main Conference Sessions
- ▼ Training Seminars
- ▼ The largest HP-Related Expo of the Year
- ▼ Management Symposium
- ▼ Manufacturing Symposium
- ▼ Keynote Addresses

Keynote Address

by Rick Belluzzo

Executive Vice President
and General Manager, Computer
Organization, Hewlett-Packard Co.

More than 120 sessions will focus on HP-UX issues, including:

- ▼ Reliable Enterprise Administrative Workflow
- ▼ Implementing NFS in HP-UX Release 10.30
- ▼ How to Choose the Right HP-UX Patches for My System
- ▼ New Developments for 10.x Filesystems
- ▼ Enterprise Desktop Management
- ▼ What's New with HP-UX? Threads, 64-bits, 2000 and the Future
- ▼ Service Management with MeasureWare and PerfView
- ▼ HP-UX & Windows NT: How to Select the Right Server
- ▼ Making the Transition from C++ to Java
- ▼ A First Look at Netware for HP-UX 4.1 Performance
- ▼ Windows NT and HP-UX Integration Using Advanced Server/9000
- ▼ HP-UX & Windows NT Integration: How to Make the Mixed Environment Work
- ▼ Internet Protocol (IP) Security Framework
- ▼ Secure Highly Available Transactions Over the Enterprise
- ▼ Performance Analysis of HP-UX Systems Using Glance
- ▼ Developing Patching Strategy for HP-UX 10.0
- ▼ MeasureWare and PerfView for Windows NT
- ▼ How to Leverage Your Existing Applications on the Web
- ▼ Working with Netscape Enterprise Server on HP-UX
- ▼ Managing UNIX Startup and Shutdown Scripts
- ▼ Intranet as a Corporate Communications Tool
- ▼ An Introduction to System Maintenance Functions for HP 9000 Servers
- ▼ Viruses, Trojan Horses, and other Vermin on UNIX
- ▼ Taming UNIX—An Introduction to Performance Management for HP-UX
- ▼ HP-UX System Performance Analysis 101
- ▼ Data Warehousing on a Shoestring Budget



Featuring more than 200 HP-related exhibitors, the HP World '97 Expo is expected to attract more than 8,000 attendees.



Product Focus

DESIGNBASE Version 5.2

An object-oriented solid and surface modeling engine, Ricoh Corporation's DESIGNBASE has been used by software developers as a foundation for CAD and related applications. In its most recent release, Version 5.2, DESIGNBASE adds more advanced offset and shelling functions, enhanced online documentation and C++ interface, and IGES solid read/write capability. Traditionally a UNIX workstation tool, DESIGNBASE now supports Windows NT and Windows 95.

Ron Hall, Ricoh's DESIGNBASE sales manager for North America, said the modeling software's extensive capabilities have enabled companies to create programs for commercial distribution as well as customized in-house software. "We have 500 commands and 2,000 APIs," Hall noted. For more than a decade, this robust development tool has dominated the market in Japan, where it is more common to custom-design software than to rely on commercial software, Hall explained.

Commercial programs created using DESIGNBASE include the solids module in MICROCADAM's Helix design sys-

tem. Ricoh continues to market DESIGNBASE primarily for CAD/CAM use, but Hall revealed that some real-time virtual reality game and simulations developers were considering using the tool for future development.

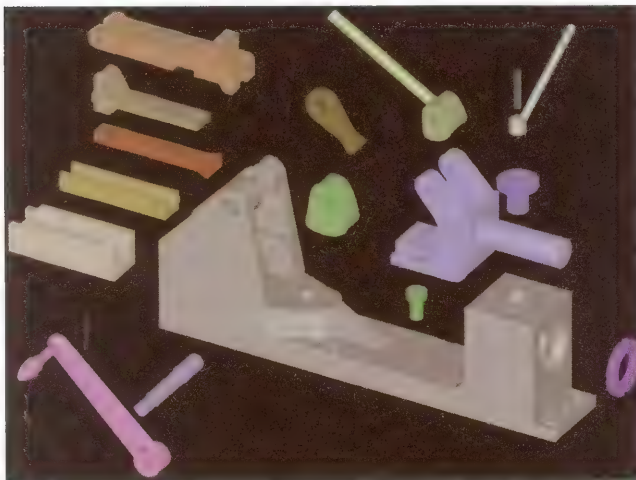
Most notable of DESIGNBASE's new features, said Hall, is the "extremely advanced

offset and shelling functions," which enable developers to "generate offsets automatically from existing topology, including face-sets with complex filleted intersections, or 'collapsing topology' situations." Enhanced offset functions include shelling, sharp corner offset, round corner offset, and offset collapsing technology. Version 5.2 further utilizes its support for Gregory surfaces, which ease creation of smooth surface-to-surface connections, enable the modeling of complex free-form shapes, and provide highly flexible surfaces control. Developers can create free-form surfaces and complex solids with extruding, revolving, sweeping, blending, offsetting, rounding/filleting, and interpolating, among other modeling operations.

A key DESIGNBASE feature is its use of a unique technique called meta-modeling, which allows developers to build solid models by capturing, replaying, and editing sequences of modeling operations. These operations are displayed in a graphical schematic history tree window, which allows developers to edit models with unlimited undo and redo, cut and paste, and point-and-click GO TO operations.

Meta-modeling is but one facet of the tool's ease of use. The prototyping and simulation functions are graphical, and while development is done primarily through a command interface, DESIGNBASE's extensive help system can guide users through code generation. Developers have instant access to the 2,000 API functions—from low-level routines like calculating intersection curves to high-level functions like rounding—through context-sensitive help and an online documentation system that includes explanations of arguments, error

Ricoh Corporation's DESIGNBASE



messages, sample programs, and graphical examples.

The tool's graphical nature lends it to implementation on Windows NT quite well, but Ricoh's primary reason for supporting Windows NT is the "significant increase" in developers' interest in the platform. Hall observed that for many developers, "their next strategy for a product release is on NT." In fact, he added, 95 percent of the developers with whom he is in contact have a strategic focus on NT development.

DESIGNBASE Version 5.2 is priced at \$35,000 per seat. Site licenses and pricing discounts are available. Ricoh charges royalty fees for products developed with DESIGNBASE for commercial distribution.

Contact Ricoh Corporation, phone: (408) 954-5464, fax: (408) 954-5466.

Michelle Pollace, hp-ux/usr New Products Editor, writes Product Focus.

Speedware OrderPoint 3.0

Speedware OrderPoint 3.0 is a packaged Web development toolset that allows businesses to set up secure electronic storefronts integrated with dynamic inventory and pricing records as well as payment and shipping information. With the recent introduction of Version 3.0, the product's name was changed from the Speedware Store to OrderPoint because of Speedware's shifting market focus, targeting mainly business-to-business concerns (primarily manufacturing and distribution) rather than retail.

Designed for use in intranets and on the Internet, OrderPoint offers a point-and-click interface, custom selection criteria, graphical icons, and a proprietary keyword search engine that allows

end users to select up to seven fields. It also features support for multiple payment methods, international tax calculation options, and frame implementation, which can be configured based on the user's resolution.

Users don't need specialized programming to set up their storefronts, but those wishing to customize by incorporating graphics or other elements can access the HTML code to do so. "We've built a very powerful back end and tried to give as many options as possible for how users want their site to look or operate, yet allow them to effect those options simply by turning on a radio button or checking a box," says Lori Ellsworth, director of marketing and business development for Speedware's Internet applications. "We've also designed fairly extensive importing facilities, based on a flat file concept, so that if you have your data in some other source, it's simple to import it into OrderPoint and make use of it right away, so you don't have to do extensive data reentry."

OrderPoint is not just EDI with a pretty interface; it can be accessed with any Web browser. Users can set up sites accessible to the general public or only to certain individuals using login names and passwords.

When it comes to security in electronic commerce, Ellsworth says, there are two primary concerns. The first is operating in a secure environment and being able to authenticate users, and the second is providing secure financial transactions. OrderPoint can be deployed in secure environments supporting both SHTTP and SSL technologies (the security layers in servers), so any information that's entered is automatically encrypted. "If you have your

electronic commerce application on a secure server, such as SHTTP or SSL, the next area of security is financial transactions," according to Ellsworth. "We've chosen to connect to third-party products specifically designed for that purpose, one of which is CyberCash. We have integrated our application with CyberCash so that everything about an order is passed off to them. CyberCash is the first third-party vendor we've chosen to work with, but our strategy for incorporating current and future technologies will be to continue to adopt those that become standard as they come along."

Platforms supported include Windows NT, Windows 95, HP-UX, Sun Solaris, and IBM AIX. OrderPoint works with most databases, including Oracle, Informix, Sybase, SQL/Server, ALLBASE, and ISAM. It is priced at \$25,000 for Windows NT and \$30,000 for UNIX. Interactive demonstrations of OrderPoint and other Speedware products are available at the company's Web site (see address below).

Contact Speedware Corporation, phone: (416) 408-2880, fax: (416) 408-2872, <http://www.speedware.com>. ■

Teresa Thomas, freelance writer, contributed this Product Focus piece.



New Products

Diagramming and Flowcharting

Confluent, Inc. has announced Visual Thought 1.3, a diagramming and flowcharting tool that runs natively on both UNIX and Windows.

Visual Thought provides over 100 general and special-purpose shapes for applications such as software design, flowcharting, network diagrams, business graphics, or Web graphics. Users can "attach" an arbitrary program or file to any shape or connection, then run it by clicking on the attachment button. Sound annotations can be easily recorded into shapes and edited with the full-featured, flexible sound editor.

Drawing features include 100 levels of undo; a library of shapes arranged in dozens of drag-and-drop palettes; and rubberbanding connections. The "live" WYSIWYG feature shows users exactly what they're doing, even while dragging objects.

The plug-in export translator technology in the new release allows users to export an entire document or just selected objects to a file from dozens of file formats, including: Encapsulated PostScript (EPS or EPSI), GIF, TIFF, JPEG, Sun Raster, XWD, and MIF (FrameMaker Interchange Format).

Visual Thought 1.3 pricing starts at \$495.

Contact Confluent, phone: (415) 764-1000 or (800) 780-2838, fax: (415) 764-1008, e-mail: info@confluent.com.

Server Cluster Failover

Conley Corporation has announced SafePath, which provides automatic error recovery for server-to-RAID data path failures.

SafePath supports standard adapters, clustered (up to 4) servers, and dual-active data paths. It adds adaptive routing to a subsystem in order to monitor the con-

dition of all data path components.

In a cluster environment SafePath allows multiple hosts to access the same RAID subsystem. In addition, with active-active data paths, the software provides a substantial performance increase over traditional single bus configurations. Using SafePath, each host automatically senses status changes in data paths, including RAID controllers, cables, and host bus adapters. A failure in any of these areas results in an immediate re-routing of I/O requests, and a complete data path recovery in seconds with no impact on server applications. After a data path has been restored SafePath allows for automatic fallback.

Contact Conley Corporation, phone: (212) 682-0100, fax: (212) 682-0071, e-mail: info@conley.com, <http://www.conley.com>.

Windows and UNIX Integration

FacetCorp has announced FacetWin Version 1.1, a Windows-to-UNIX integration solution including transparent file and print services, terminal emulation, PC backup/restore, e-mail and modem servers and remote computing support. FacetWin Version 1.1 is immediately available and includes enhanced server and terminal emulator features.

FacetCorp based the file and print services in FacetWin upon the Common Internet File System (CIFS) formerly known as SMB. This is the primary system that Microsoft Windows uses for networking PCs. FacetWin's UNIX CIFS server requires no additional software to be loaded on the PC to get completely transparent file and print services. The only part of FacetWin to run on the PC is the terminal emulator, which was designed as a native 32-bit application for Windows 95 or NT.

TAMING UNIX

An Introductory Guide to Performance Management
for the HP-UX System Administrator

By Robert A. Lund

A WISE
INVESTMENT
FOR ONLY
\$59.95



You, the humble and righteous system administrator, Whilst in the midst of performing your duties,
are nearly overcome by a herd of renegade daemons.

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 - ◆ Memory Management
 - ◆ Load Balancing Techniques
 - ◆ Capacity Planning
 - ◆ HP-UX Kernel Tables
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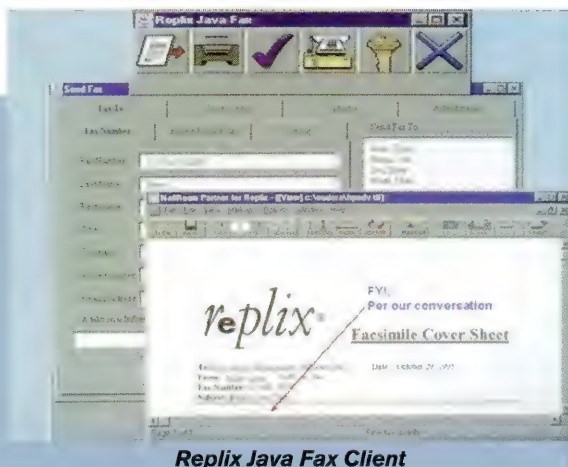
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Fax Automation

SoftLinX has announced the Replix Java Fax Client, offering true platform independence and full integration with SoftLinX's Enterprise Fax Solution and messaging system. The Replix Enterprise Fax Solution is a highly scalable, wide-area fax management system used to fax-enable business applications, leveraging corporate networks and the Internet. Replix also provides Internet Service Providers with enhanced features for outbound and inbound faxing.

The Replix Java Fax Client provides users with universal and remote access to the Replix fax messaging from any platform that supports Netscape Navigator and Microsoft Internet Explorer. It runs on Windows 95, Windows NT, and HP-UX.

Contact SoftLinX, phone: (508) 392-0001, fax: (508) 392-9009, <http://www.softlinx.com>.



C-Kermit

C-Kermit 6.0 is a major new release of C-Kermit communications software for HP-UX (all versions from 5.21 to 10.30) and all other known varieties of UNIX. It replaces C-Kermit 5A(190), which is preinstalled on HP-UX 10.xx platforms by agreement between Hewlett-Packard and the Kermit Project at Columbia University.

C-Kermit is a combined serial and network communication software package offering terminal connection, file transfer, character-set translation, and automation through its cross-platform script programming language, which is available on UNIX and on OS/2, Windows 3.1, 95, and NT, and DOS.

C-Kermit 6.0 is the first version of C-Kermit that works properly on HP-UX 10.10 and above. Earlier versions of C-Kermit do not work on HP-UX 10.10 or higher because of changes in the HP-UX runtime libraries.

All of the new features of C-Kermit 6.0—as well as all those added in all releases since 5A(188)—are completely documented in the new revised and expanded second edition of the Digital Press book, *Using C-Kermit*. C-Kermit 6.0 and the book are available now by mail order. The C-Kermit software is also available via anonymous ftp to kermit.columbia.edu, directory *kermit*.

Contact the Kermit Project, phone: (212) 854-3703, (212) 663-8202, e-mail: kermit-orders@columbia.edu, <http://www.columbia.edu/kermit/>.

C++ Code Analysis

ParaSoft Corporation has announced CodeWizard for Windows NT and Windows 95. For a limited time, this C++ code analysis tool for Windows 95 and Windows NT can be downloaded from

FacetWin Version 1.1 is immediately available and is free to existing licensed users, as is technical support. Any FacetWin licensed customer may download and use this version without re-registering the software. Pricing remains at \$195 for a single-user license of FacetWin with multiple-user discounts. A free, 30-day evaluation copy is available. FacetWin Version 1.1 can be downloaded from <http://www.facetcorp.com>.

Contact FacetCorp, phone: (972) 985-9901.

Web-based Helpdesk

UniPress Software, Inc. has announced Java capability for its FootPrints helpdesk for UNIX and Windows NT. The helpdesk system records and tracks problems, solutions, bugs, and related information and makes that information available to anyone with access to the Internet or Intranet.

FootPrints enables customer support professionals and users to take immedi-

ate advantage of the Internet's benefits: global access, self-service, faster response times, and immediate feedback. Adding the Java applet makes it even easier to manage FootPrints sessions, to manage the Web browser, and to manage information. The FootPrints ControlPad option provides users with point-and-click access to all FootPrints functions. It also launches a FootPrints session in a separate browser window, leaving the original browser available to run other functions.

An evaluation copy of FootPrints can be downloaded from http://www.unipress.com/cgi-bin/free_evals.

The FootPrints Starter Pack includes the server software and three licenses and is priced at \$1,995. Additional licenses are available at \$495 each. FootPrints requires a Windows NT or UNIX-based Web server and supports all Web browsers.

Contact UniPress Software Inc., phone: (800) 222-0550 or (908) 287-2100, e-mail: info@unipress.com.

ParaSoft's Web site at no charge.

Based on Scott Meyers' popular book, *Effective C++*, CodeWizard reads C++ source code and automatically indicates violations based on the rules described in the book.

CodeWizard helps programmers to deeply understand Meyers' rules by putting them into the perspective of their own code.

CodeWizard is tightly integrated with Microsoft's Developer Studio and parses code and automatically reports rule violations to the developer. It improves code design, checks code for portability, and prevents the misuse of language-specific features.

CodeWizard for Windows NT and Windows 95 is available at no charge. CodeWizard for UNIX is available at \$995.

Contact ParaSoft Corporation, phone: (888) 305-0041, fax: (818) 305-3036, e-mail: info@parasoft.com, <http://www.parasoft.com>.

Web Site Links Checker

Electronic Software Publishing Corporation (Elsop) has announced LinkScan, a link checker that operates on UNIX servers. LinkScan can test over 30,000 links per hour and produces two types of Web site maps. LinkScan's SiteMap enables the user to produce a site map that includes every link on a Web site arranged in a hierarchical format that resembles a book's table of contents. LinkScan's TapMap is an expandable and collapsible site map that allows viewers to tap down through multiple levels to easily explore the Web site.

Elsop's LinkScan reports and SiteMaps may be viewed using any of the standard Web browsers, such as Netscape Navigator 1.2 and up and Microsoft Internet Explorer. LinkScan is designed to run on UNIX and Windows NT servers.

Within a Web site, LinkScan scans for missing HTML documents, images and other files; validates all internal hyperlinks; checks all name tags and references; creates site maps or table of contents suitable for publication; and discovers orphaned files. LinkScan also probes each external hyperlink to other Web sites.

Free evaluation copies of LinkScan may be downloaded from <http://www.elsop.com>.

Licenses are \$495 each. Licenses for charitable non-profit organizations, educational institutions, or individuals for personal use are \$49.95 each.

Contact Elsop, e-mail: linkscan@elsop.com, <http://www.elsop.com/>.

Systems Monitoring

Heroix Corporation has announced RoboMon Version 6.1 for UNIX, which features universal database monitoring and problem solving, as well as enhanced support for SNMP-based frameworks such as OpenView and NetView.

Monitoring of databases, such as Oracle, Ingres, and Sybase, is provided via the new RoboMon Omni-Collector, which enables system managers to

instruct RoboMon to monitor and take actions on problems based on any data that can be generated by the computer system. RoboMon detect problems with the database itself and can also detect anomalies in key company data, such as sales, inventory, or cash levels.

RoboMon Version 6.1 also supports a specific trap number, which can be used as a severity indicator, on the SNMP action it uses to report to network managers such as OpenView.

RoboMon ships with an extensive out-of-the-box rule set which enables system administrators to easily use, extend, and tailor the product for site-specific requirements.

RoboMon for UNIX prices range from \$300 to \$2,500 per machine.

Contact Heroix, phone: (800) 229-6500, e-mail: pr@heroix.com, <http://www.RoboMon.com>.

Network Data Acquisition Server

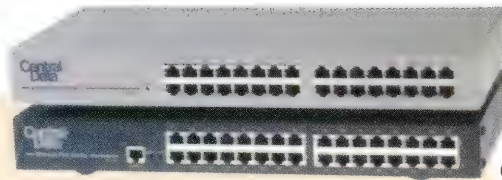
Real Time Integration, (RTI) Inc. has announced the NetAcquire 3000, a network data acquisition server that acquires, processes, and updates real-time analog data at over 750,000 samples/second. NetAcquire 3000 uses a standard Ethernet network to commu-

Enterprise Data Access

CROSS ACCESS Corporation has announced Version 3.0 of the CrossAccess Data Delivery System. New features include significant performance enhancements and support for 32-bit ODBC technology. The product also provides enhanced query optimization for nonrelational VSAM data sources and simplified management for complex MVS server environments.

CrossAccess Version 3.0 is said to provide an estimated 400 percent when performance improvement for relational, non-relational enterprise data access.

Contact CROSS ACCESS, phone: (630) 954-0500, fax: (630) 954-0554.



Central Data Terminal Servers

Terminal Servers

Central Data Corporation has introduced two new terminal servers with 32 serial ports each. The EL-32 EtherLite Port Server provides 32 ports from one Ethernet TCP/IP session. The ST-1032 scsiTerminal Server, supports 32 serial ports from one SCSI address. EtherLite Port Servers and scsiTerminal Servers can connect to modems, printers, terminals, and other RS-232 I/O devices.

Both the EL-32 EtherLite Port Server and ST-1032 scsiTerminal Server connect 32 asynchronous, RJ-45 serial ports to a system running UNIX or Windows NT. The EL-32 is compatible with a 10Base-T Ethernet network, while the ST-1032 attaches to a standard SCSI bus. The ports will transfer data at speeds up to 115 kilobaud. Surge protection is provided on all serial lines for reliability, and full modem control and hardware/software flow control ensure data integrity.

Pricing for either unit is \$1,995.

Contact Central Data, phone: (800) 482-0315 or (217) 359-8010, fax: (217) 359-6904.

nicate with a client computer monitoring and displaying the results. The product can be a component in building local-area distributed test and measurement systems and is Internet-compatible.

The NetAcquire 3000 has been optimized as a real-time platform with an onboard 486 processor running a true real-time operating system.

Its industry-standard TCP/IP Ethernet network interface allows data acquisition from MSDOS, Windows 3.1, 95, NT, and UNIX. Up to 10 NetAcquire boxes can be run in parallel with each networked client computer.

The NetAcquire 3000 is priced at \$8,495 and includes server and client software for Windows 3.1, 95, and NT.

Contact RTI, phone: (206) 883-7563, fax: (206) 883-0463, e-mail: realtimeint@realtimeint.com.

Data Availability

Quest Software Inc. has announced SharePlex Replication, a complete replication solution for UNIX file systems and heterogeneous RDBMS. SharePlex makes data available in a very comprehensive manner by pro-

viding real-time database and file system replication across multiple remote-ly located systems.

SharePlex deploys data warehouses, real-time continuous backup of operation databases, load balancing, and disaster recovery strategies in distributed environments.

The product has high speed, flexible multiple-tier architecture, and comprehensive administration and monitoring tools. It can also replicate any type of changes on any type of file in the UNIX file system.

Contact Quest Software, phone: (800) 306-9329.

Mass Data Storage

ATG CYGNET has announced the VFD 16000 disk drive, which provides 16 GB of online data storage. The system uses 12-inch WORM (Write Once Read Many) disks based on digital optical technology.

The Hexadisc, a unit featuring six of the removable WORM disks, offers a 96-GB capacity when coupled to the VFD 16000. Two VFD 16000 units can be integrated in a jukebox to extend storage

capacity to 2.3 terabytes, which can be accessed in less than 8 seconds. Sector access time is 90 milliseconds.

Contact ATG CYGNET, phone: (33) 5 62 14 21 02, fax: (33) 5 61 41 03 49 (France), or contact the French Technology Press Office, phone: (312) 222-1235, fax: (312) 222-1237 (U.S.).

New from Hummingbird

Client Library

Hummingbird Communications Ltd. has announced the SOCKS Version 4 client library for Windows NT 4.0. The installation of Hummingbird's SOCKS client on an NT workstation enables network administrators to control access to the Internet and corporate intranet for all Winsock 1.1 or 2.0 compliant TCP/IP applications in a way that is completely invisible to users.

SOCKS Version 4 is an IETF open-systems protocol specifying a circuit-level proxy gateway for controlling access to TCP/IP networks. A SOCKS server is placed between a private enterprise network and a public network, such as the Internet, or between a workgroup and other security domains on an intranet. The Hummingbird SOCKS client on the desktop installs between any Winsock 1.1 or 2.0 compliant TCP/IP client and the Winsock DLL, intercepting all requests for connections with outside hosts and referring them to the SOCKS server. The server then allows or disallows the connections based on settings established by the network administrator, and it establishes a safe circuit between the client and host.

The product is available for free download from <http://www.hummingbird.com>.

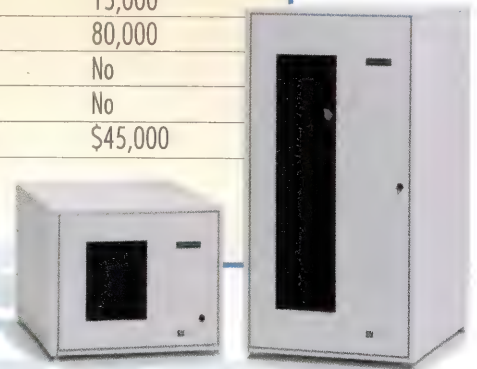
Continued on Page 78

Thinking about DLT?

Think again! We know that many of you are thinking about DLT tape libraries. But recent advances in **8mm** and **4mm** technology—and tape libraries made by StraightLine—might make you want to think again.

Model	StraightLine SL-400 Series	StraightLine SL-800 Series	ADIC	ATL
Drive format	4mm	8mm*	Scalar	ACL 4/52
Number of tapes in library	18 or 24	20, 50, or 150	DLT 4000	DLT 4000
Throughput	up to 25.8GB/hr	up to 108GB/hr	up to 43.2GB/hr	up to 43.2GB/hr
Total capacity	up to 586GB	200GB to 7.5TB	2.08TB	2.08TB
Bar code reader	Yes	Yes	Yes	Yes/6-digit
Number of drives	1 to 3	1 to 5	2 to 4	2 to 4
Head life (hours)	>20,000	>20,000**	10,000	10,000
Media uses (passes)	20,000	20,000	15,000	15,000
Drive MTBF (hours)	200,000	200,000	80,000	80,000
Tape drawer(s)	Yes	Yes	No	No
Removable tape boxes	Yes	Yes	No	No
List price starting at	\$7,995	\$13,995	\$17,995	\$45,000

* Exabyte's recommended 8mm tape—Exatape 170M Advanced Metal Evaporated tape
Sony's recommended 8mm tape—SDX-T3N 170M Advanced Metal Evaporated tape
** Exabyte Mammoth head life—20,000 hours
Sony AIT SDX-300 head life—30,000 hours



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number of tapes—20, 50, or 150 tape systems—offering up to **7.5TB** of data storage and **108GB** per hour throughput.

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Industry Standards — StraightLine libraries are compatible with all standard systems and software—Sun, HP-UX, SGI, IBM RS/6000, Sequent, NT, DEC; Novell, LAN Manager; Arcada, Legato, ArcServe, and many others.

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Question & Answer

Q: How can I obtain the size of RAM currently installed on my CPU?

A: There are a number of ways:

You can watch the machine as it boots up and (quickly) write down the number of megs of RAM installed. Or you can use the command `/etc/dmesg` (`/usr/sbin/dmesg` for 10.xx) and look at the values listed for memory. On Series 800 (9.xx only), you can use the command `/etc/sysdef`. Both `dmesg` and `sysdef` require root capability.

A brute force way (for small memory sizes) would be to count the bytes in `/dev/kmem` as in:

```
wc -c /dev/mem
```

This will require 100 percent CPU time, a long time if the RAM is more than 32 megs or so.

Here is a program that will work:

```
/* Get actual memory size in bytes */
#include <stdio.h>
#include <sys/pstat.h>
main()
{
    struct pst_static buf;
    pstat_getstatic(&buf, sizeof(struct pst_static), 1, 0);
    printf("%d\n", buf.physical_memory * buf.page_size);
}
```

It just prints out the size of RAM in bytes as one big number.

Here's an extension that shows virtual memory too:

```
#include <sys/pstat.h>
main() {
    struct pst_static stat_buf;
    struct pst_dynamic dynam_buf;
    pstat(PSTAT_STATIC, &stat_buf, sizeof(stat_buf), 0, 0);
    pstat(PSTAT_DYNAMIC, &dynam_buf, sizeof(dynam_buf), 0, 0);
    printf(" Physical memory = %ld MB\n", stat_buf.physical_memory/256);
    printf(" Virtual memory = %ld MB\n", dynam_buf.psd_vm/256);
}
```

Q: I have lots of files called 'core' on my system. How can I determine the name of the program that created them?

A: For 10.xx systems, use the file command as in:

```
# file /opt/pd/share/man/core
/opt/pd/share/man/core: core file from `more' - received SIGABRT
```

In this case, the *more(1)* command was terminated with the SIGABRT signal. For 9.xx systems, use *adb* as in:

```
$ echo '$m' | adb core | grep from
/ map (inactive)          `core' from `sleep'
```

but it isn't as reliable as *file(1)* at 10.xx.

Q: I am trying to run a program from */etc/rc* (startup) but it seems to quit before I can log in.

A: If your daemon is being started at boot time from a startup script such as */etc/rc*, its child processes (including your background program) are probably being killed when the process running */etc/rc* exits. Make sure that your daemon code calls *setsid()* so that it doesn't run as a child of the */etc/rc* process. Another option is to run the daemon as a batch job (*at*) set to start at a time after */etc/rc* has finished.

Q: What are the messages logged by JetDirect using the syslog code in the JetDirect family of cards?

A: When the HP JetDirect interface is enabled for TCP/IP network protocol, the card can generate syslog messages and send them to a syslog server specified in the SYSLOG SERVER field. This may be useful in identifying error conditions or to track changes over a period of time.

To enable this feature you must specify the IP address of the syslog server either through bootp and the SNMP params set up by jetadmin software, via the front panel, or through utilities such as telnet. Only one syslog server may be configured, and the JetDirect interface will not generate syslog messages unless a syslog server has been configured.

Below is a list of the message strings that can get generated by

the JetDirect interface and logged to a file. These message strings are logged to the file */usr/adm/syslog* (HP-UX9.xx and earlier) or */var/adm/syslog/syslog.log* for 10.xx versions of HP-UX.

The error messages are displayed in the following format:

Date Time IP Addr printer: <message strings>

for example:

Mar 23 12:20:13 12.34.56.78 printer: powered up

The following message strings are part of the syslog facility:

```
"error cleared"
"unknown"
"powered up"
"image dump to <IP ADDRESS> "
"image dump to <IP ADDRESS> failed with TFTP error <NUMBER>"
"config file error line: <NUMBER> <FILENAME>"
"status change"
"ready to <PRINT/PLOT/RUN>"
"not ready to <PRINT/PLOT/RUN>"
"busy with other I/O: "
"offline or intervention needed"
"paper problem"
"paper out"
"paper jam"
"toner/ink low"
"page punt"
"memory out"
"cover/door open"
"output full"
"error: <NUMBER>"
"peripheral fatal error: <NUMBER>"
"network peripheral interface fatal error: <NUMBER>"
"interface reconfigured"
"TFTP config file fetch from <IP ADDRESS> failed with TFTP error ##"
"system name changed"
"connection from <IP ADDRESS> denied due to access failure"
"connection with <IP ADDRESS> aborted due to <REASON>"
```

The following strings may be displayed in the <REASON> field:

"unknown reason"
 "synchronization error"
 "insufficient memory"
 "max. retransmission count exceeded"
 "foreign side aborted"
 "SYN received on open connection"
 "duplicate socket"
 "local close acknowledged"
 "foreign side closed"
 "foreign side initiated close"
 "security check failed"
 "destination unreachable"
 "error on connection attempt"
 "connection attempt timed out"
 "connection accept timed out"
 "no response to keepalives"
 "peripheral front panel reset"
 "SNMP SetRequest reconfigured interface"
 "SNMP SetRequest aborted Connection"

4. Add the new printer using the dumb model script:

```
/usr/lib/lpadmin -p<printer_name> -mdumb -v/tmp/printer
```

5. Start the scheduler:

```
/usr/lib/lpsched
```

6. Allow the spooler to queue new jobs to that printer:

```
/usr/lib/accept <printer_name>
/usr/bin/enable <printer_name>
```

7. Send a test job to the printer and then look at the contents of the file. For example:

```
/usr/bin/lp -d<printer_name> /etc/passwd
```

Note that the file will be overlaid rather than appended for each job.

Q: How can I print directly to a file?

A: This is useful when you need to trace the exact characters and escape sequences being sent to the printer or log the data being created by some program. Here are the steps:

1. Create a file that will be used as the destination. For example:

```
touch /tmp/printer
```

2. Set the owner and group on the file so that the *lp* process will be able to write to it:

```
chown lp:lp /usr/tmp/printer
chmod 644 /usr/tmp/printer
```

3. Shut down the scheduler:

```
/usr/lib/lpshut
```

Q: I administer a number of workstations running various levels of HP-UX 9.x. I add hundreds of new users to the systems every quarter. How can I force users to alter their passwords upon first logging in and every four weeks thereafter?

A: You can use password aging. Password aging is controlled by an optional field in the password file entry. This aging field follows the password:

```
username:password[,pw_age]:userid:groupid:idstring:homedir:command
```

Notice that the aging field must follow a comma if it is to be used. The format of this field is:

```
,max min wks
```

max: The maximum number of weeks the password can be used before it must be changed. This is a single character.

min: The minimum number of weeks the password must be used before it can be changed. This is a single character.

wks: The number of weeks since the password was last changed. This is an encrypted field that is used by the login program.

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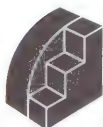
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CIRCLE 124 ON READER SERVICE CARD

The max and min value are encrypted characters. Here's their translation:

Character	Weeks
.	0
/	1
0-9	2-11
A-Z	12-37
a-z	38-63

So, if you want them to change their passwords every four weeks, you need to set max to 4, which is 2 when encrypted. Let's say that you want them to use the password for at least one week. That means that min will be 1, or /. You will add ",2/" to the end of each password.

Since the login program writes the "wks" string, it will not be there when users first log in. As a result, they will be forced to change the password. Thereafter, the aging will be enforced.

Q: I add and remove users to my system using SAM. I have added a new application to my system that necessitates particular action when a user is removed from the system. Is there a way to automate this process through SAM?

A: SAM does offer task customization in this area. You can choose to have a script run before or after the user is actually removed. An example script is provided at `/usr/sam/lib/ct_rmuser.ex`. Also notice that a similar example script is available for adding users.

The example script is simply a skeleton script that processes the parameters passed by SAM. The script describes the four possible parameters that will be passed.

First, copy this script to another file name. Make sure the file has execute permission and write privilege for only the appropriate users. Add your commands to this script. Before testing this script with SAM, make sure that it runs properly at the command line.

When you are sure that the script is executing correctly, run SAM to add the customization. Make the following menu choices:

Accounts for Users and Groups

Users

Actions: Task Customization

The subsequent screen will allow you to enter the full path of your script. If you have trouble with the script, check out `/var/sam/log/samlog` after your SAM session for details.

Q: I have written a script that uses the *newgrp* command to change the group id associated with the process. I have found that the commands after the *newgrp* command are not executed. What is the problem?

A: The problem is that *newgrp(1)* starts a new shell that replaces the current shell. So, you have a couple of choices. First, you can create the file */etc/login.group* effectively to give your users privileges of all of their group memberships simultaneously. See the man page for *group(4)*.

Or, you may be able to use a trick to use the *newgrp(1)* command in your script. See the following script:

```
#!/bin/sh
echo "Beginning of script"
id
sh -c "newgrp group1" <<!
echo "In 1st newgrp"
id
!
echo "Between newgrp's"
id
sh -c "newgrp group2" <<!
echo "In 2nd newgrp"
id
!
echo "End of script"
```

You should see output that is similar to this:

```
# ./test.sh
Beginning of script
uid=132(spotter) gid=20(users)
In 1st newgrp
uid=132(spotter) gid=210(group1) groups=20(users)
Between newgrp's
uid=132(spotter) gid=20(users)
In 2nd newgrp
uid=132(spotter) gid=220(group2) groups=20(users)
End of script
```

Q: I have just migrated my systems from 9.x to 10.10. I

have several software packages that I created with *fpkg* at 9.x. How can these be converted for use at 10.x?

A: You can convert these packages using the command *fpkg2swpkg(1M)*. This command is available via the 10.x Core media or the 9.x Conversion and Analysis Tools media. The command can be run at 9.x or 10.x.

This command helps to translate existing *fpkg* product specification files (PSFs) into a format the SD-UX command *swpackage* can use. The *fpkg* keywords are converted to *swpackage* counterparts when available. The *fpkg* keywords with no *swpackage* counterpart are included but commented out in the *swpackage* PSF.

Manual edits and use of the *swpackage(1M)* command complete the process of generating a *swpackage*-format depot from the *fpkg* information. See the *fpkg2swpkg(1M)* man page for more details.

Q: I use the commands *du(1)* and *ll(1)* to display the size of files. I have noticed that the output from these two commands is almost always different for the same file. Usually, *du(1)* reports the larger size, but occasionally *ll(1)* shows the larger value. What is the cause of this discrepancy?

A: *ll(1)* reports the size of a file as it exists in the size field in the inode structure associated with the file. It reflects the amount of data in the file. *du(1)* reports the number of 512-byte blocks that have actually been allocated to store this file's data and additional data block pointers.

As you have pointed out, the value returned by *du(1)* is usually larger than that returned by *ll(1)*. The most obvious reason for this difference is that the last data block is seldom completely full. Also, if the file needs more than 12 data blocks, one or more additional blocks are used for pointers to data blocks.

So, these blocks do not contain actual file data, but they are reflected in the output of *du(1)*.

If the *ll(1)* value is larger, the file must be a sparse file. A sparse file contains "holes." In HP-UX, data blocks are not used to represent these holes, which would be full of nulls. If the file were copied out to tape, it would be its

"l" size on the tape. This is common in some database applications.

Q: I just installed a new application on my workstation that occasionally fails to run correctly. I receive the following message on the console:

```
Cannot get shared memory - OS error 28
```

It seems to report an operating system error. Do I need to call my application vendor, or is this an HP-UX problem?

A: When you receive an error message from an application, it is always a good idea to call the application vendor. The message is actually generated from the application, not HP-UX. HP support may not be able to interpret this message. However, it is often possible to diagnose the problem on your own if an HP-UX error number is provided.

In this case, the operating system error is 28. The first thing you should do is check the file `/usr/include/sys/errno.h`, which defines error codes with their associated numeric value. Looking at this file, you can see that ENOSPC is defined as 28.

The second step is quite a bit more difficult. You need to determine what HP-UX function produced the error. In this case, you know that shared memory was involved. If you are not familiar with the functions that handle shared memory, try using the *whatis* file. You can do this by using the "-k" option of *man(1)*.

```
# man -k "shared memory"
ipcrm(1)      - remove a message queue, semaphore set or
                shared memory id
shmat, shmdt(2) - shared memory operations
shmctl(2)     - shared memory control operations
shmget(2)     - get shared memory segment
```

So, this is a good place to start. This is where the interpretation of the message can cause a problem. This message, however, is fairly straightforward. The function *shmget(2)* seems to be the best bet.

The third step is to examine the man page for the func-

tion. Any valid error values will be documented. In this case, you are looking for ENOSPC. From the man page for *shmget(2)*:

```
[ENOSPC] A shared memory identifier is to be created but
the system-imposed limit on the maximum number
of allowed shared memory identifiers system
wide would be exceeded.
```

It looks as if you are out of shared memory identifiers. This can be addressed by increasing *shmmni* or terminating other processes that utilize shared memory.

This technique can be used for various HP-UX function failures. If the error number is not provided, it is extremely difficult to determine the cause of failure. Accordingly, the application vendor is the best resource for interpreting the message. ■

General HP-UX questions are answered by Bill Hassell, a support engineer at the HP Atlanta Response Center. He can be contacted via e-mail at blh@hpuaatl.atl.hp.com. Workstation questions are answered by Susan Potter, an HP-UX system support engineer in the Atlanta Response Center. Her e-mail address is sup@atl.hp.com.

The X Window System and HP-UX/NT Interoperability

by Marty Poniatowski

When introducing Windows NT into an established HP-UX environment, a variety of technologies enhance Windows NT and HP-UX interoperability. Two widely used HP-UX technologies are also available on Windows NT from a variety of sources. These are the X Window System (X Windows) and Network File System (NFS). I will cover X Windows in this article and NFS in an upcoming issue of *hp-ux/usr*.

These two technologies come with the HP-UX operating system. You can buy versions that run under Windows NT and thereby bridge the gap between some fundamental differences in operation between these two operating systems. Although there are many other important interoperability topics, and more products being introduced every week, I have decided to focus on these two products because of their wide use in the HP-UX community and the maturity of the Windows NT system products. The following two bullets summarize the approach I am taking to these two topics.

- **HP-UX Application Server That Displays on HP-UX Using the X Window System** (covered in this article)—X Windows is the standard networked windowing environment on HP-UX systems. If you install X Windows on your Windows NT system, you can run applications on your HP-UX system and use X Windows on your Windows NT system to manage those applications. The HP-UX system is acting as the application server but the applications are controlled from X Windows running on the Windows NT system.
- **Network File System (NFS) Used to Share Data**—The next article covers using NFS to share data between Windows NT and HP-UX systems. NFS comes with HP-UX and by loading NFS on a Windows NT system you can freely access the HP-UX file system on the Windows NT systems and vice versa.

Why the X Window System?

HP-UX and Windows NT have distinct user interfaces. They are different and well suited for their respective operating systems. If you have the luxury of using only HP-UX or only Windows NT, you won't need to consider the most effective way to open a window from one system into the other.

If, however, you want to access both HP-UX and Windows NT systems on a regular basis, you want to consider X Windows. The X Window System is an ideal way to get remote access to an HP-UX system while sitting on your Windows NT system.

X Window System Background

X Windows is a network-based windowing environment, not a system-based windowing environment. X Windows is an industry standard for supporting windowed user interfaces across a computer network. Because it is an industry standard, many companies offer X server products for operating systems such as Windows NT (we'll get into the "server" and "client" terminology of X Windows shortly). X Windows is not just a windowing system on your computer but a windowing system across the network.

X Windows is independent of the hardware or operating system on which it runs. All it needs is a server and a client. The server and client may be two different systems or the same system; it doesn't matter. The server is a program that provides input devices such as your display, keyboard, and mouse. The client is the program that takes commands from the server, such as an application.

The client and server roles are much different from those we normally associate with these terms. The X Windows server is on your local system—in this article it will be your Windows NT system—and the X Windows client is the application that responds to the server—in this article the HP-UX system running a program such as the System Administration Manager (SAM) or HP SoftBench. We normally think of the small desktop system as the client and the larger, more powerful system as the server. With X Windows, however, it is the system that controls X Windows that is the server; the system that responds to the commands is the client. I often refer to a powerful client as the "host" to minimize confusion over this.

Sitting on one of the Windows NT systems on a network, you could open an X Window into several HP-UX hosts. You could therefore have one window open to *HP-UX_System1* and another window open to *HP-UX_System2*, and so on.

X Server Software

There are many fine X Server products on the market. I loaded Exceed 5 from Hummingbird Communications Ltd. on my system for demonstrating how X Windows can be used in a Windows NT and HP-UX environment. *Figure 1* shows the full menu structure on a Windows NT system after loading both Hummingbird's X windows product Exceed and its NFS product.

Not all of the items shown in the Programs-Exceed menu are related to X Windows. Many are for the networking products I'll get into in the next article.

FIGURE 1 X Windows and NFS Menu on a Windows NT System



FIGURE 2 Establishing an X Windows Connection

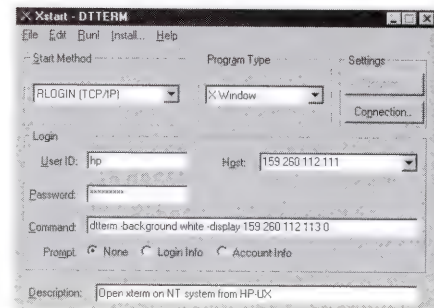
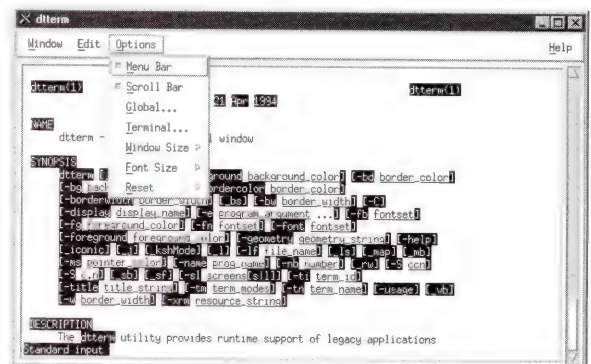


FIGURE 3 ddterm Running on HP-UX and Displayed on Windows NT



Continued on Page 26

FIGURE 4 *xterm Running on HP-UX and Displayed on Windows NT*

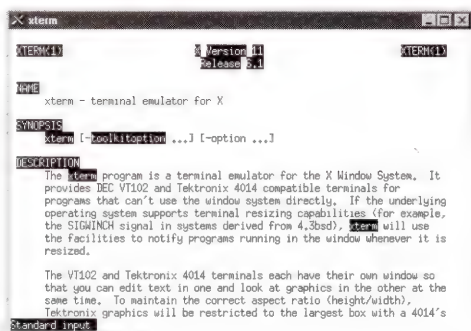


FIGURE 5 *SAM Running on HP-UX and Displayed on Windows NT*

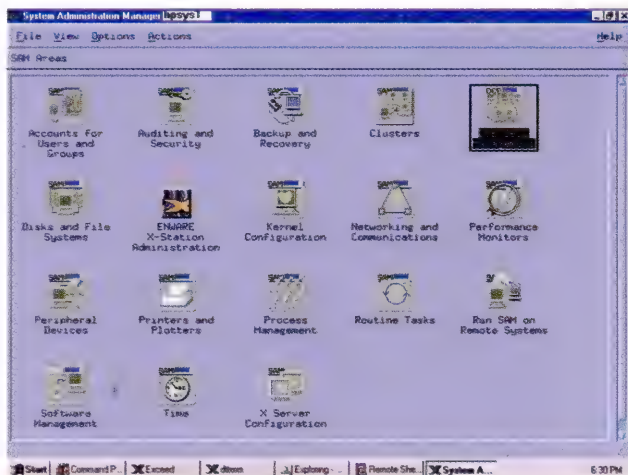
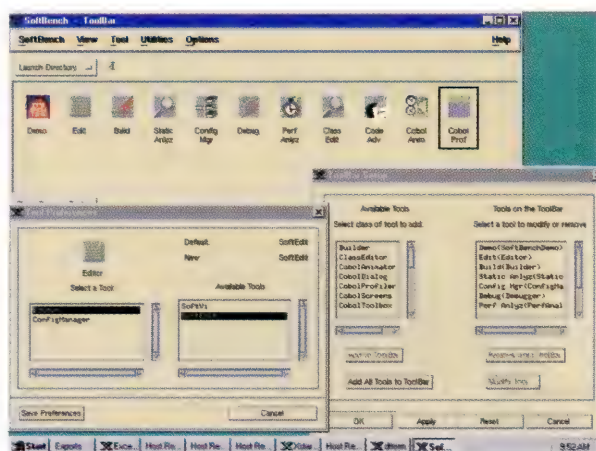


FIGURE 6 *HP SoftBench Running on HP-UX and Displayed on Windows NT*



The last menu pick under Exceed is Xstart. This menu pick allows you to establish an X Windows connection between your Windows NT system and the HP-UX system. You can specify the host to which you want to connect, the HP-UX system in this case, the user you want to be connected as on the host, and the command to run on the HP-UX system. Figure 2 shows the Xstart window.

The window in Figure 2 is labelled "dterm." After you set up the Xstart window with the information you want, you can save the configuration. In this case I am issuing the *dterm* command, so I saved the window under this name. The complete *dterm* command is:

```
dterm -background white -display 159.260.112.113:0
```

This command will start a standard HP-UX *dterm* window with a white background and display it on the system at the IP address 159.260.112.113. The IP address in this case is the Windows NT system on which you are issuing the command, which is the X Windows server. The *:0* indicates that the first display on the Windows NT system will be used for *dterm* because in the X Windows world it is possible to have several displays connected to a system. The system on which the command runs is 159.260.112.111. This is the HP-UX system, which acts as the X Windows client.

When you hit Run! from the pulldown menu, the *dterm* command will be run on the host you have specified in the dialogue box. Although you are typing this information on your Windows NT system, this command is being transferred to the HP-UX system you specified in the Xstart box. This will have the same result as typing the *dterm* command shown on the HP-UX system directly. When you hit Run! a *dterm* window appears on your Windows NT system that is a window into your HP-UX system.

Figure 3 shows the *dterm* window open on the Windows NT system but running on the HP-UX system. The window has open the HP-UX manual page for *dterm* and one of the pulldown menus of *dterm*. You could issue any commands in this *dterm* window that you could issue if you were sitting on the HP-UX system directly. Keep in mind, though, that your access to the HP-UX system is based on the user you specified in the Xstart window.

You could use Xstart to run any program for which you have appropriate permissions on the HP-UX system. Figure 4 shows an *xterm* window displayed on the Windows NT system

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but running on the HP-UX system. You are by no means limited to running only terminal windows such as dtterm and xterm under X Windows in this environment. You could perform system management functions as well. *Figure 5* shows the System Administration Manager (SAM), the system administration interface standard on all HP-UX systems, running on the HP-UX system and displayed on the Windows NT system with DCE Cell Management selected. In this case I have maximized the SAM window to take up the entire Windows NT environment. You still have access to the Task Bar at the bottom of the screen.

Another common use of X Windows software in this environment is for program development. *Figure 6* shows the HP SoftBench development tool running on the HP-UX system and displayed on the Windows NT system. An application such as SoftBench opens up many X Windows on the Windows NT system; these are handled for you by the X server software.

The technique of using X Windows on the Windows NT system to display applications running on the HP-UX system is powerful in this heterogeneous environment. It is also inexpensive and simple to install. We can take this interoperability one step further by introducing data sharing into this mixed environment. In the

next article I'll cover using NFS running on Windows NT to mount HP-UX disks across a network. X Windows combined with NFS can provide solid interoperability technology to your Windows NT and HP-UX environment. ■

Based in the New York area, Marty Poniatowski is a technical consultant with Hewlett-Packard who works on both server and workstation installations. He has written more than 50 technical articles in computer industry trade publications. He has also written four books published by Prentice Hall: The Windows NT and HP-UX System Administrator's "How To" Book (1997); Learning the HP-UX Operating System (1996); HP-UX 10.x System Administration (1995); and The HP-UX System Administrator's "How To" Book (1993). All can be ordered by calling (203) 377-4746.

Security



ILLUSTRATION BY KAREN TOKMAKOFF

Concepts:

The Questions You Should Ask Yourself

This article poses important general security questions for managers, system administrators, and users of computer systems, in an attempt to make those associated with computers think about security issues. While the author has worked mostly with UNIX systems, the questions posed are also applicable to any kind of computer, from server-based networked PCs to mainframe systems.

Questions For Managers

How seriously is security taken in your organization? Do your actions and policies reflect this?

Do your overall business practices as they relate to computers reflect the importance of security to your organization? Is it obvious to everyone that security is important to you or do your practices suggest otherwise?

Too often managers claim to be interested in security, but their actions say otherwise and the result is a break-in waiting to happen.

Do you make it clear to employees why security is needed? Do they understand the advantages to them? Do they understand the risks to the company?

It should be clear to each and every employee why security is important. Losses to the company mean losses to employees and a less open, more restrictive environment. Training sessions should be held. You may wish to have employees and other users sign non-disclosure agreements. Managers should have regular informal feedback sessions with computer users to gauge their understanding of the importance of security.

The author's experience with companies to which he has provided security consulting is that managers may expect employees to know the importance of security, but rarely check to find out if they really do.

Have employees bought into the importance of security?

It is necessary but not sufficient for employees to understand the benefits of security and the consequences of its failure. Employees must "buy into the program" or they will do what they can to get the job done in spite of restrictions imposed by security measures. If employees truly appreciate security and believe it is an integral part of their responsibility, then it becomes easier to implement and even stricter security measures can be avoided.

Do employees know what the security rules are and what the consequences for violations are?

The specific security rules must be clear and concise. They have to be taught to each employee. Regular formal and informal sessions must be held. It is not only necessary for users to understand the general ideas, but they must know the specifics for selecting good passwords and the consequences of giving them out to others. Employees must clearly know the potential as well as actual consequences for failing to practice security.

Are security violations taken seriously by management?

What happens when a security violation occurs? Are violators counselled or disciplined? Are all employees treated equally or are high-level violators given wrist slaps but ordinary employees severely disciplined? Is it acceptable for managers to write down their passwords by their terminal but not for users to do the same?

Is management more lenient toward those who are lax about security than those who cause a security breach?

There is a difference between those who commit a security lapse, such as not having a good password, and those who commit a security breach by giving away the password. Are

by John A. Pezzano

such differences appreciated or are users nailed so hard for minor violations that they will cover up failures? The result could be a more catastrophic security problem later.

Those who commit violations that do not result in a loss of security must be counselled and reminded that security is for everyone. Those who cause loss or destruction of data should be held strictly accountable.

Are security measures practiced by managers?

Employees will take clues from how managers act to help them decide how serious management is about security. Managers who violate their own rules are not taken seriously. I worked on a security problem where the only administrator password that could be broken belonged to a manager. How believable would he be to his employees when he tried to justify stricter security? What message was he sending them?

If actions are to be taken against employees for security violations, a creditable defense to management as well as in a lawsuit will be that the supervisors do the same thing.

Do employees and administrators know their role in good security?

Both users and administrators play a role in security. Managers should work closely with administrators to analyze vulnerabilities, design in security on new applications and systems, tighten security on existing ones, and prepare and analyze security plans and policies.

User input is critical if you are to avoid security becoming so pervasive that it affects the ability to get the mission accomplished or causes employees to find ways to get around it.

The author's experience is that non-technical managers ignore these issues because they don't understand them. Security concepts don't require a degree in Computer Science, but the questions need to be asked.

Do you have a security incident plan?

What is your plan if a security breach is discovered? Do your users and administrators know whom to contact and how to do so? Do you know when to call law enforcement and when to contact your corporate counsel? Do you know how to treat information as evidence and how to protect it? What is your plan to protect your system from further loss if a problem is discovered? Should the system be shut down? Should remote access be disabled? All these things and more should be documented in a Security Incident Plan. Administrators and off-hours operators should know where the plan is and be encouraged to act on it.

Often these issues are ignored until a break-in occurs. Then a lack of planning causes additional problems. The author was involved in a case where management overreacted to a perceived security incident and could have been involved in a large lawsuit had not their attorney wisely recommended they say nothing until all the information was known. Users were locked out of the system and an administrator was suspected of misconduct. The facts showed that there was no breach and no violation of procedures but just a combination of miscommunication and misunderstanding that was considerably worsened by the failure to have an Incident Plan in place.

Is security treated as a positive or a negative?

Is security considered a positive or negative in your organization? What is the general attitude? Do users believe it is there to make their job difficult or there to protect them? Do you impose security rules or ask them for input on how to make their access easier while at the same time having good system security? Is security strong but transparent?

If users know they won't get a hassle if they need more capability, they are less likely to complain if they haven't been given full access in the first place. On the other hand, if they have a job to get done and security prevents them from doing it, they will view it as a serious obstacle to success and may act inappropriately.

Do you have a written security policy? When was it last updated?

Few companies have a security policy and fewer put it in writing. What are users allowed to do and what may they not? What constitutes legitimate personal use? What is the role and responsibility of the administrator? Can users look at others' files? Can they use the system any time they want or only to do certain jobs or during certain hours? When must permission be asked prior to doing something beyond the scope of their normal responsibilities?

Do you plan to do something about users who violate unwritten, unknown policies? Do you think that idea will fly past your corporate counsel, much less an opposing attorney in a lawsuit?

Have you updated your policy to account for WWW access, downloading files of questionable taste, encrypting files so managers can't see what might be on systems for which they are responsible, and other issues that didn't even exist a few years ago? Do you now have Internet access but don't address it in your policy?

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Do your systems clearly display that unauthorized use is prohibited?

Government prosecutors have, at times, rejected trying criminal cases against hackers because system logins displayed "Welcome ..." instead of a notice advising that system access was restricted.

Your initial message to all users should indicate that the system is restricted to management-authorized users and unauthorized use is prohibited. It might also state that users' keystrokes may be monitored.

Have you sent your administrators to security training?

Security isn't magic. Hackers and malicious users are getting more sophisticated and have numerous readily available tools for attacking your system. Have you thought about sending your administrators to training courses on good security procedures?

There are classes, seminars, and conferences on security and it might be a wise investment to send one of your administrators to them.

Do you have a process for monitoring compliance with your security policy?

You have set up your security policy and it prohibits certain personal use, requires strict regularly changed passwords, and defines what users and administrators must and must not do. How do you verify all this? Do you have a way to check that the policy is being followed?

Depending on how strict you need to be, how automated you can make the process, and how much users can be trusted, you may wish to check daily or not at all. If all your users are permanent trusted employees and only local access is possible, then checking would not be as strict as when you have employees of customers or vendors dialing into the system or connecting across the internet. Similarly, a financial system would require more security than a training system.

Do you have a process for evaluating the usefulness of your security policy and making needed changes?

Once a policy has been established, is it cast in concrete? Do employees feel they can come forward and make suggestions to keep the security while at the same time relaxing the rules? Do you have a defined team for regularly reviewing the policy to take into account the latest technology? If CD-ROM writers that are now rare become common, do you have procedures in place to recognize that an addendum will be need-

ed to define rules about duplicating not only computer CD-ROMS but copyrighted music CDs?

Have you had an independent security audit?

No matter how good an administrator is, an outside security audit is as important as an outside financial audit. You need to bring in someone to look at your policy, your procedures, and your system to see if they meet good security practice, as well as your requirements. A regular independent security audit is a must. If you don't have a corporate team to provide such an audit, consider hiring an outside consultant. Make sure you know the credentials of any outsiders both as to their ability to do the auditing as well as their honesty and integrity.

Have you done a vulnerability assessment? Have you followed up on it?

Unlike an audit, a vulnerability assessment looks at how your system can be broken into and what the consequences would be. The analysis is intended to expose your weaknesses and must be carefully done. The resulting information should be carefully protected and immediate follow-up is critical to preventing any weakness from being exploited.

Do you know your personal and corporate legal and financial vulnerability?

How vulnerable are you personally, and your company as an entity, for loss or public exposure of private data? Have you reviewed your liability and theft insurance to see if you are covered for employee lapses, security failures, computer break-in, and intentional contractor and employee actions that result in loss or improper public exposure? Are you protected if an employee uses your system to break into someone else's? What if someone breaks into your system and, as so commonly happens, uses it as a springboard to attack other systems? Have you sat down with your corporate counsel to find out what needs to be done to minimize liability?

Have you asked your counsel what is required to notify users that the system they are on is restricted for company use? Are your policies, warnings, and procedures legal? Are they enforceable?

Do you know your legal obligations and responsibilities?

Do you know your responsibilities if an employee attempts to break into a competitor's system? Are you required to notify them even if the attempt failed?

What do you need to do to ensure evidence is protected if someone breaks into your system? What constitutes evidence?

Are you permitted to read users' mail? When can you monitor keystrokes on user terminals?

Have you asked your system administrators for their recommendations on security?

It is important to sit down on a regular basis with your system administrators to get their input on the effects of security on system performance, system usability, and system manageability. Adding too many security features to a system can slow the performance of the system itself and result in huge log files of little meaning. If users can't accomplish their jobs, their performance and morale will be affected.

Can administrators adequately manage the system? Administrators should be critically questioned as to their practices and security procedures. Are they setting good examples? Are they regularly reviewing log files? Do they periodically test the system and evaluate its security? Are they providing you with recommendations on policy changes as they implement new technology?

Do you ask vendors to explain the security of their products? Do you see if security is imbedded in a product or added on as an adjunct?

When vendors propose new equipment or software, do you ask them about security? Have they incorporated it in the product? Does that database ensure that unauthorized users can't just dump out raw data? Does that new system really have the ability to separate users from each

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other or is it based solely on trust? How vulnerable is the product to break-ins? Does the product have the ability to integrate with products that provide encryption and secure authorization? What security standards does the product meet?

Do you have in a high-level manager's safe the current administrator passwords to your systems?

It is amazing to watch what happens when solving a system problem requires administrator passwords and the administrator cannot be reached. You need to have quick access to necessary passwords, but at the same time you don't want everyone to know those passwords. Do you have a good way to keep them protected yet have them available at any time no matter what happens?

A good system is to limit the passwords to as few people as possible but have your procedures allow essential

personnel to go to a high-level manager to retrieve the password from a safe. Thus, a manager or manager's secretary knows who asked for the password and when and why it was needed.

Questions for Administrators

Do you have security turned on? Is the default "ON"?

Many systems come with optional security. Is it enabled on your system? Is the system set up so that when new users are added, security is maximized for them? Security should be turned on, then reduced if it is not necessary. Otherwise, it is entirely possible for the system to be compromised prior to securing it, thus leaving a back door already in place.

Are you qualified to secure a system?

The fact that you have the responsibility to administer systems doesn't

mean you are qualified to make sure they are secured. Should you request that management send you to a security class? Do you understand your system's vulnerabilities and strengths? Do you know how to activate security and what the "cost" is?

Do you purchase or recommend security products?

If you have authorization, have you evaluated or purchased encryption and authorization/access products? If management has to authorize purchase, have you recommended such products to them? Have you incorporated security products in your budget?

Do you back up and protect security information?

Do you separately back up security information such as anti-virus or sniffer programs? Do you separately keep and protect data on file and program checksums, versions, protection information, and size? Are such backups protected from unauthorized access?

Do you look at security data?

If your system gathers data on successful and unsuccessful logins, do you look at it on a regular basis? Do you look at other security log files? Do you have some method of perusing the files for unusual activity? Do you have a way that the system can automatically notify you that there is a problem? Do you know about products that provide this capability?

Do you do something about suspicious or out of ordinary things?

When you see something out of the ordinary, do you immediately check it out? Do you verify that the unusual access really was by an authorized user by calling the user or the user's manager?

Do you practice security yourself in your everyday activities?

Since users will likely take the administrator's actions as their own, it is important that the administrator practice good security. Do you have your own back doors? Do you have weak passwords because it is easier? Do you bypass the lock to the computer room because you go in and out so often? Do you fail to sign in because everyone knows you anyway? Do you dial in from home when you are not supposed to because it's easier than driving in to check up on a problem?

Do you know of system weaknesses? Have you done anything about them?

Administrators are the ones most likely to find system secu-

rity weaknesses. Have you contacted the vendor or filed a CERT advisory? Have you contacted management to warn them of the weakness? Have you taken actions to prevent problems or minimize their effect?

In the past, many vendors provided by default "guest" accounts with no password or vendor support accounts with the same password on every system shipped. While this practice has generally ended, you might ask your system or application vendor if such accounts still exist on your system.

Are you using real security rather than "security by obscurity"?

Simply not telling users about ways to do things improperly doesn't constitute security. While this may work for uninformed or unconcerned users, a knowledgeable user will be able to exploit system weaknesses. Is the only reason why your system is secure the fact that users haven't gone down to the bookstore to read up on how it works?

Does a high-level manager have a copy of the passwords?

If you are unavailable, it may be necessary to get quick access to the system. You should be providing the current passwords to a high-level manager who can protect them in a company safe and who can authorize their release as necessary in case of emergency. This beats having to give out the administrator password when you are gone just to ensure that you will not be disturbed when on vacation.

Do you know the plan if a security incident occurs?

As an administrator, you are a key element in protecting a system that has been broken into. Do you know management's plan? Do you know whom to contact during off hours? Do you know if the whole system should be shut down? Is it acceptable just to disable network access or shut off remote modem access? Can you protect the system quickly and efficiently with minimal interruption? Do the operators know how to do it? Can you describe via phone to other users or managers how to shut down the system safely if you cannot be on site? Do you have written instructions easily available near the system?

Do you teach new users good security practices?

A new user will quickly develop habits based upon what is initially taught. Unlike long-time users, who might resent new security practices, a new user usually accepts almost any reasonable rule. The administrator can get the new users off

on the right foot by advising them of security practices, by setting their accounts up properly, and by explaining how best to secure their personal files.

Do you practice the concept of minimal capability?

Do you initially give users only the capability they really need or do you give them full access? Sometimes it is best to minimize what new users can do, particularly if they are untrained or if they are on probation. Users will tend not to become resentful and will accept restrictions if you are willing quickly and without hassle to expand their capability as they need it.

Do you practice open administration?

Administrators who are open and friendly to users run into fewer problems when restrictions have to be imposed. On the other hand, if you act as if the system is your personal property and users are intruders, they will resent your security restrictions and will believe you are just trying to be the computer dictator.

Do you keep a documented record of changes, patches, updates, and upgrades?

Any system modifications should be carefully documented. Such information should be kept in a written log with a copy kept off site in case of fire or similar destruction. Do you have a logbook? Do you regularly update it?

Do you minimize the number of people who know the administrator passwords?

It should not be necessary for everyone to know the administrator passwords. If the only way that operators can perform their job is to have administrator access, then alternate methods need to be explored. If a vendor or other user has a temporary need to have administrator access, the passwords should be changed as soon as the need is satisfied.

Do you regularly review your security practices?

You should take a critical look at your security practices in an attempt to improve them. You should encourage management to require an outside security audit and cooperate fully with it. While it is natural to resent outside interference or the embarrassment of having an outsider expose a security weakness, it is far better than having to explain a break-in and data loss.

Do you read security information?

There are many excellent security books and manuals. There is also security information available on the Internet and from the Web. Do you keep up with the latest recommendations on firewalls? Are you current on encryption, authorization, and authentication techniques?

Do you know about the CERT advisories? Do you know how to get them? Do you read them? Do you act on them?

The Computer Emergency Response Team (CERT) publishes advisories on security. Do you know how to get their advisories and do you follow up with your vendors or check your system as necessary? Do you document in your log each appropriate advisory and what action was taken?

Are you familiar with the strengths and weaknesses of applications you are using? Have you asked the vendors for security recommendations? Have you checked the security of the applications yourself?

You should ask vendors of applications what they recommend to maximize security. Often high security will cause applications to fail because they were not properly designed. Such problems should be reported to the vendors and if appropriate, to CERT. The vendor should be asked to provide an appropriate fix as soon as possible while you implement interim security and notify management.

Do you ask or do you independently record the size, checksum, directory location, and protection access on third-party files and programs?

When third-party vendors provide applications, you should request that they provide information so you can, at any time, verify the integrity of their files and programs. Typically, the product includes primarily programs and files that should not be modified along with a few that are designed to be customized.

When I am called in as a security consultant after a break-in, this is one of the first pieces of information I ask for. While I usually know or can get the information on my company's products, there is no way I can easily tell if someone has modified a third-party vendor's product since I don't know what it should have been in the first place. Rarely have administrators asked the vendor for this information. The result is that the software may have to be re-installed from the originals and the customizations recreated.

Continued on Page 36

There are tools that create the integrity verification information, but it must be done as soon as a product is installed to avoid having the information already compromised.

Have you made regular security recommendations to management appropriate to their technical knowledge and the capability of your system?

It is an administrator's responsibility to warn management of weaknesses and to recommend security practices and products. Often when information is provided, it contains jargon too technical for the manager and nothing is done. You should make sure that management understands the security strengths and potential weaknesses so they can make informed decisions.

Would a new administrator be able to maintain your security?

The use of customized security procedures can do much for protecting a system. However, when such customizations are poorly documented or not documented at all, a new or additional administrator cannot understand them enough to maintain or properly use them. Any customizations should be clearly documented for easy maintenance.

Questions for Users

Do you understand how important security is in protecting your work?

Most users understand that management has imposed security restrictions to protect the business but often they forget that it protects their work also. If there is a break-in on your system, do you have data that you would have to retype? Would you enjoy having to try to recreate that great proposal you wrote? Would you like your project delayed by days while your files are restored and then your work re-entered?

Do you have anything out on your system that you would prefer not being public knowledge at this time?

Do you understand that security protects you personally?

If someone breaks security on your system, he may use your identification to send malicious messages or to break in to other systems. You may be blamed and have to defend your integrity.

While nothing may be proved against you, you may be viewed with suspicion. Management may publicly exonerate you, but your fellow employees may mistrust you. You need to understand the importance of security to you as well as to your organization.

Do you walk away from your terminal while still logged on?

Even if you are only gone for a minute, someone can do damage in your name. Often that minute is interrupted by a conversation or a request for immediate action by a manager. If you forget, someone else may take advantage of you.

I was involved in such an incident many years ago when a user left an unattended terminal and someone removed system files. Anything that is done in your name is going to be blamed on you and you need to be careful about protecting your terminal.

Do you clear your screen when you log off?

Often personal or system information can be gleaned just by looking at what was left on the screen. If you are entering, modifying, or reading sensitive data, make sure that such data cannot be seen by someone after you get off the system and leave. Does the terminal or PC have screen memory that allows someone to page back to look at previous data? If so make sure that the memory is erased or your workstation is turned off.

Do you have back doors?

Do you have a way to get on the system that bypasses standard security? Such back doors often are used by malicious attackers to gain system access. If you can't get to your system easily with normal procedures, then it is time to sit down with management and discuss making access easier without compromising security.

Do you try to beat the system?

If you are told not to do things a certain way for security, do you try to beat the system? If the system checks for new passwords that are the same as old ones, do you really make the new one different or just make minimal changes? If you are not permitted to add personal programs from home or from the net, do you do it anyway then create ways to hide what you did?

The author was involved in an incident where users were developing programs that had bugs that caused disk files to be overwritten. Until the problems were worked out, they kept the backup tapes nearby to restore when necessary. However, policy required that all backups be stored off site. Because getting the backups from the offsite location took two days and extra paperwork, the users simply kept the backups locally and turned in blank tapes for offsite storage. Had there been a fire, the computer would have been replaced but all their programs lost. They risked the loss of months of work as well as their jobs to save a little time and trouble.

Do you know what to do if you observe a security problem?

If you observe strange behavior of programs or something strange about a system that would lead you to suspect that there is something wrong, do you know your organization's policy for doing something and/or reporting the problem to management and administrators? Are you willing to say something?

Do you understand the concept of weakest links?

In any organization, the chain is only as good as the weakest link. If you are not practicing good security and someone tries to break into your system, they are going to try and find that weak link. Once they have broken into the system using your identification, they will use that to try and gain administrator access or use your identification to attack other systems. It is important that your link not be the one that is weaker than the rest of the chain.

Do you provide maximum protection (minimum access) for your personal files and programs?

Do you practice the concept of minimum access? Do you set your file and/or program protection to allow others to access only what is necessary? If you have the need to share files, separate them from your other work in a separate directory so other users cannot even read your private files.

Do you back up your work if it is not done often enough by administrators?

Administrators back up (or should back up) the system regularly. How often this is done depends on overall system needs, time and personnel availability and is a tradeoff between the potential

loss of data and the "cost" of doing the backup. As a group, users' files might not change very often. But yours might. You could be doing a special important report with a lot of new work. You might regularly make more changes than others. You might work on files for which the data is all new. Therefore, if loss of data will result in a high cost to replace it, you should either back up your work individually or have your administrator perform a special backup.

Your backup might consist of tape or floppy copies of your files or even duplicate files in a backup directory. In any case, you need to ask yourself if you can afford the loss of data.

Do you check your files for unauthorized changes?

Often a break-in is first detected by a user who notices that files or programs have been modified or accessed while the user was not logged on or was on vacation. You should be aware of changes in your files that are abnormal. While it may be true that you occasionally have lost data through your own error or because of "just one of those things you expect to happen," you should assume that any data change not directly attributable to a specific action on your part should be investigated and possibly brought to the attention of management or administration.

Do you know what you are allowed to do and what you are prohibited from doing?

You should know what constitutes acceptable behavior on your system and should ask management if you are not sure. Can you send personal e-mail outside the company? Can you download files from the Internet? Can you look at other users' files? Can you browse the system? Can you give out your password

in an emergency and what should you do if you have had to do so? What information sent to you electronically can you forward to others?

Are you observant about unusual activity?

Is someone logged in who is known to be on vacation? Is there activity on certain ports when there never is at that time of the day? Have some seemingly innocuous files been changed for no apparent reason? Do dialout telephone line charges seem unusually high or are they for destinations that don't make sense? Are there some unknown files on the system?

Summary

These questions are intended to make managers, administrators, and users think about their responsibilities in making a computing environment secure from malicious attacks from outside as well as inside an organization. If you don't address these issues, you are much more likely to be someone calling the author or another security consultant as well as law enforcement to ask for help after a problem. ■

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by Frederick F. Chew

Coffee Talk:

Going from C++ to Java

The official release of the Java Developer's Kit (JDK) 1.0 by Sun Microsystems in May 1996 drew a flurry of attention for this Internet programming technology. New products to promote Java development have been appearing in a steady stream. Symantec Visual Café 1.0, Microsoft Visual J++ 1.0, Asymetrix SuperCede 1.0, and Hewlett-Packard's HP-UX Developer's Kit for Java 1.02 are just a few examples.

The Java programming language has many syntactic similarities to C and C++. Java is an object-oriented language, not a procedural language. In many ways, one can think of it as a highly simplified version of C++ with some unique features of its own. Experienced C programmers who have yet to be exposed to C++ will learn Java more easily than C++. Many of the tricky or controversial features of C++, such as operator overloading, multiple inheritance, and templates, are not available in Java. Java does not even support pointer variables (no *address of* (&) and *de-reference* (*) operators).

As a multi-paradigm language with numerous features, C++ gives unbridled freedom to the software developer. The developer is free to write code that is creative, convoluted, or confusing. This freedom means the programmer must thoroughly understand the language and use its features intelligently. Such technical maturity does not come right away; it requires many years of dedicated practice.

Java, on the other hand, reduces the enormous number of choices the programmer must make and provides a better atmosphere for him to become successful. As an object-oriented language, it is much more philosophically consistent than C++ and does not carry any of the baggage of the past. If you are a practitioner of encapsulation and an opponent of spaghetti code, you will appreciate the lack of *friend* functions and *goto*.



Experienced C++ developers should not have too much difficulty integrating Java into their technical skill set. It is mostly a matter of unlearning some things, understanding the equivalent things, learning some new things, changing habits, and a lot of practice. This article will talk about some key differences between Java and C++. I will be explaining this from the Java perspective with the assumption that the reader has had some experience with object-oriented programming in C++.

Java as a Development Environment

Unlike the traditional approach in which a compiler generates a binary code file that can be executed only on the target platform, the Java compiler (named *javac*) takes the source file (with *.java* extension) and produces a bytecode file (with *.class* extension). The bytecode file is a set of special instructions to be executed by a program called the *virtual machine*. Any operating environment with a Java virtual machine (named *java*) can execute a Java byte-



code file. The virtual machine can be a separate program residing in the file hierarchy of some operating system or it can be built into a Java-aware Internet browser such as Netscape Navigator Version 2.0 or higher.

The Java scheme for doing software development is very attractive because one can write the code once, transfer it to any platform with Java virtual machine support or a Java-aware Internet browser, and expect the code to run predictably (at least that's the noble objective). For a software firm, there are no longer expensive campaigns to port code to accommodate target platforms.

As a simple example, suppose I have the source file called *Tutor.java* shown in *Listing 1* (an abbreviated listing). To compile the program,

```
javac Tutor.java
```

is executed from a command line.

If successful, the result is a bytecode file called *Tutor.class*. Assuming the bytecode file represents a stand-alone program and not an applet (which can be executed only from within a browser), the program can be launched from the command line:

```
java Tutor
```

The file extension is understood to be *.class*.

Memory Management: Community Service or Do It Yourself?

As an experienced C or C++ programmer, do you remember all of the long hours spent searching for dangling pointers and missing statements to free dynamically allocated heap memory? Conscientious memory management was difficult enough with C, but with C++, this task took on a new dimension of complexity (throwing exceptions without deleting what's already allocated, forgetting to use *delete []* for arrays of objects, missing virtual base class destructors, etc.).

Now, C and C++ programmers can breathe a sigh of relief. Thanks to garbage collection built into Java, programmers need not worry about freeing dynamically allocated memory when it is no longer useful. Periodically, the built-in garbage collector checks each block of allocated memory. If a block has no variables referring to it, the block is returned to the free pool, where other threads and processes can use it.

The Java programmer needn't write code to call the garbage collector. However, if he wishes to invoke garbage collection explicitly, he can do so with the statement:

```
System.gc();
```

The garbage collector eliminates the need for operations like *free()* (from C) and *delete* (from C++).

LISTING 1 *Tutor.java*

```
import java.awt.*;
import java.io.IOException;
import Humans.*;
public class Tutor extends Pupil {
    public Tutor(String nm, String id, char sx, int yrs, String sc, int lv, String sj, String prof) {
        // statements
    }
    public void DisplayData() {
        // statements
    }
    private String subject;
    private String professor;
    public static void main(String args[]) {
        Tutor fred = new Tutor("Fred", "630-22-0980", 'M', 35, "University of California,
                                                                    Santa Cruz",
                                                                    4, "Mathematics", "Dr. Jane Garvin");

        fred.DisplayData();
    }
} // end of class Tutor
```

Move Aside, ASCII, Unicode Is Here

In C and C++, the character is represented by a single byte (8 bits) in the form of the built-in *char* type. With eight bits, a maximum of 256 characters can be represented and over the years the ASCII collating sequence became the accepted ordering of these characters.

On the other hand, Java has adopted Unicode, a two-byte standard for character representation. Each Unicode character is a sixteen-bit *unsigned* value. With Unicode, as many as 65,536 characters can be represented! This means that non-Roman languages such as Chinese and Korean can be accommodated very comfortably.

The ASCII collating sequence is actually a subset of Unicode and this sequence appears as the first 255 characters in the Unicode sequence.

In both Java and C++, the `'\'` or backslash is used as an escape character to help represent special character values, such as the backspace, newline, single quote, and double quote. The following special characters are shared by both Java and C++:

```
\n    newline
\r    carriage return
\b    backspace
\t    tab
\f    formfeed
\'    single quote
\"    double quote
\\    backslash
```

A statement such as

```
char backspace = '\b';
```

would declare a char variable called *backspace* and have it initialized to `\b` (the character value is bounded within single quotes).

C and C++ have a few additional special character values that are not available in Java (because of conflicts with Unicode). They are:

```
\a    bell
\?    question mark
\v    vertical tab
```

In Java, there is a special way to represent a character by its encoding scheme in hexadecimal. For instance, the declaration

```
char alpha = '\u0391';
```

means that the char variable *alpha* is initialized to the character corresponding to hexadecimal value 391 (931 in decimal), which is a capital Greek alpha. The `\u` in Java denotes a hexadecimal number. The entire Unicode sequence would range from `\u0000` to `\uFFFF`.

The Primitive Types of Java

Among the traditional obstacles C and C++ developers face when they build applications for multiple platforms are the sizes of the built-in types. The primitive *int* type is two bytes on some machines and four bytes on others. Similarly, the *long* type is sometimes four bytes, sometimes eight bytes.

To add to the confusion, a *char* type may be understood to

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TABLE 1 *JAVA Primitive Types*

TYPE	SIZE	DESCRIPTION
boolean	1 bit	A boolean can either be true or false. It cannot be cast to another type, such as int.
char	16-bit, unsigned integer	Each char is a Unicode code.
byte	8-bit, signed two's complement	Range is -128 to 127.
short	16-bit, signed two's complement	Range is -32768 to 32767.
int	32-bit, signed two's complement	Range is -2147483648 to 2147483647.
long	64-bit, signed two's complement	Range is -2^{63} to $2^{63} - 1$.
float	32-bit IEEE 754 single-precision	Range is about $-3.4E38$ to $+3.4E38$. Accuracy is about six to seven significant decimal places.
double	64-bit IEEE 754 double-precision	Range is about $-1.7E308$ to $+1.7E308$. Accuracy is about 14 to 15 significant decimal places.

be *signed* or *unsigned*, depending on the vendor's implementation on the target platform.

Java removes the guesswork on the sizes of the primitive types and whether a type is signed or unsigned by default. *Table 1* describes each of the Java primitive types.

Being of fixed size, all of the Java types are platform-independent. Unlike C and C++, Java does not have a *sizeof* operator. The predictability of the sizes for the primitive types contributes to the portability of Java programs.

The Operators of Java

Java shares many, but not all, of the operators of C++. There are a few operators in Java that are not in C++. In addition, the operator precedence and associativity of Java is very similar to that of C++.

Since Java has no pointers, the familiar *->*, *&*, and *** operators (*member selection*, *address of*, and *de-reference* operators) are nonexistent. Rather, pointer semantics are implemented in the form of reference variables (which are actually analogous to C++ references) for user-defined types. By the same reasoning, the *.** and *->** operators (pointers to class members) are also nonexistent in Java.

The scope operator (*::*) is nonexistent in Java. The membership operator (*.*) can also be used to identify a member from a particular class or particular namespace. For instance, in C++, we might have

```
Pets::Bird::getData();
```

where *getData()* is a member function of class *Bird*, which is a member of namespace *Pets*. In Java, this would be written as

```
Pets.Bird.getData();
```

In this case, *Pets* would be a Java package, the equivalent of the C++ namespace.

Java objects are created from heap memory with a form of the *new* operator, but there is no *delete* operator as in C++. When an object goes out of scope and there are no longer any references to it, the Java garbage collector automatically deallocates the heap memory. The Java programmer need not worry about dynamic memory management (but there may be other resources he needs to keep in mind for cleanup, such as input-output stream connections).

In Java, the right shift operator (*>>*) is used to do a *signed* right shift, meaning that the value of the sign bit will fill the high bits as shifting occurs. On the other hand, the *>>>* operator means to perform an *unsigned* right shift, meaning that the high bits are zero filled (including the sign bit). The *>>>* operator is unique to Java and does not exist in C++.

In C++, the meaning of the right shift operator (*>>*) is very ambiguous. It can be either a signed shift or an unsigned shift, depending on the particular vendor's implementation. This ambiguity is an historical obstacle to portability.

The left shift operator (*<<*) will perform a left shift with zeros filling the lower bits. The lower order bits will also shift into the sign bit. A *<<<* operator does not exist.

Java has an operator called *instanceof*, which can be used to determine the type of the object. For example, if we have

```
if (manual instanceof Book)
    System.out.println("manual is a Book with author
"+((Book>manual).getAuthor());
else
    System.out.println("manual is NOT a Book");
```

Variable *manual* would refer to an object of type *Book* or subtype of *Book* if the condition (*manual instanceof Book*) is true. A subtype would be a class derived from *Book*.

Unlike C, Java does not support the comma (*,*)⁴ operator for grouping expressions. In C, we could have something like

```
foo(num1, num2, (num3 = 5, num4 = 3 * num3));
```


where the third argument to function *foo()* is evaluated from left to right, resulting in a value of 15.

The + operator in Java takes on the special meaning of string concatenation and is frequently used with the *String* class, which is part of the default *java.lang* package. Unlike C++, Java does not support operator overloading for user-defined classes. The use of the + operator for string concatenation is the only exception to this rule in Java.

The Anatomy of a Java Class

Whether you are programming in Java or in C++, the *class* is the basic blueprint for object creation. The class models a real-world entity, an idea, or an event. Provided it is well conceived, it is an encapsulated unit of attributes and behaviors. By encapsulated we mean that the attributes, which represent the internal state of the object, are hidden from the outside world. Any access to those attributes is through the behaviors, if that is what the class designer intends.

Java has its own set of terminology for attributes and behaviors. An attribute in Java is called a *variable* or *field* (*data member* in C++). A behavior is called a *method* (*member function* in C++).

The variable may be an *instance variable* or *class variable*. Instance variables (which are non-*static*) are unique per instance while class variables (which are declared *static*) apply to all instances of the class.

Now, let us look at the simple example of a Java class in Listing 2 to see its basic syntactic anatomy. The execution of that code would display the following on the standard output device:

```
(0,0)
(7,17)
(19,25)
(-9,21)
(37,-93)
(-15,72)
```

A first look at the example reveals the following differences from a C++ class:

Java does not have a preprocessor that does macro string substitutions as in C or C++. Instead, classes that are to be reused are stored in packages such as *java.lang* and integrated into the client program with the *import* statement. The asterisk of *java.lang.** means to import all classes of package *java.lang*.

Package *java.lang* is part of the Java language itself and is

LISTING 2 A Java Class

```
// Source file: OrderPair.java
import java.lang.*;
public class OrderPair {
    public OrderPair() {
        x = 0;
        y = 0;
    }
    public OrderPair(int x_value, int y_value) {
        x = x_value;
        y = y_value;
    }
    public int getX() {
        return x;
    }
    public int getY() {
        return y;
    }
    public void printXY() {
        System.out.println("x=" + x + ", y=" + y);
    }
    private int x;
    private int y;
    public static void main(String args[]) {
        OrderPair pr1 = new OrderPair();
        OrderPair pr2 = null;
        pr2 = new OrderPair(7,17);
        OrderPair pair[] = {
            new OrderPair(19,25), new OrderPair( 9,21),
            new OrderPair(37, -93), new OrderPair(-15, 72)
        };
        pr1.printXY();
        pr2.printXY();
        for (int index = 0; index < pair.length; index++)
            pair[index].printXY();
        } // end of main
    } // end of class OrderPair
```

always imported into a program by default. The redundant statement is illustrated to introduce the meaning of *import*.

The definition of the class begins with the *class* keyword and its variables and methods are enclosed within braces:

```
[modifiers] class {
                                // members
}
```

A class can also have optional *modifiers* that regulate the visibility of its members to clients. Since class *OrderPair* is declared *public*, its non-private members may be accessed by classes inside or outside the *package* containing *OrderPair*. The lack of a modifier (the default) would mean its non-private members are accessible only to classes in the package containing *OrderPair*.

A *package* is a logical grouping of classes and I will illustrate how a package can be constructed a little later.

Note that there is no terminating semicolon (;) after the right brace of the class body.

The variables and methods are enclosed within the body of the class. Each of these members could also take an optional *modifier*. Generally speaking, variables hold data and are kept *private* while methods are non-private. The Java modifier is equivalent to the use of the C++ *private*, *protected*, and *public* keywords for specifying access regions within the body of the class.

In Java, the use of an explicit modifier is applied on a member-by-member basis. In addition, the *lack* of a modifier keyword is the default, which provides access to the member only for classes *within* the package.

One important difference in the Java class anatomy is that the method implementations are included within the body of the class. While this approach to coding can also be taken in C++, it is discouraged as professional developers will often conceal the member function implementations from users of their classes. In C++, the class declarations and its member function prototypes are placed in header files (.h or .hh files); the function implementations (in .cpp or .C source files) are compiled and placed in object code libraries.

In Java, the sources for the classes are compiled into byte-code files (.class files) and placed into *packages*. There are no header files. Instead, the developer can use a JDK utility such as *JavaDoc* to document the purpose of the class and its method prototypes.

As in C++, the Java class can have any number of constructors. The no-argument default constructor is the compiler default.

Unlike C++, Java does *not* support the initializer list notation nor can arguments assume default values.

There are *no* destructors in Java.

The *OrderPair* class above constitutes an executable program of its own. As such, it must implement a *main()* method. The *main()* method must have modifiers *public* and *static*, return *void*, and take an argument list of (*String args[]*) (*args* is an array of references to *String* objects). The *main()* method is the entry point for program execution.

The signature of the *main()* method is used to accept command line arguments. In C or C++, the signature for *main()* is typically (*int argc*, *char ** argv*), where *argc* represents the number of command line arguments. However, this second argument is unnecessary in Java because Java arrays know their own *length* or number of elements. To find the number of com-

mand line arguments passed to *main()* in Java, one evaluates *args.length*. The *length* variable is strictly a read-only variable (called a *final* variable) built into the Java array mechanism.

The *main()* method of class *OrderPair* simply instantiates a number of *OrderPair* objects and displays their contents. We can declare a reference to *OrderPair* and have it refer to a newly instantiated object:

```
OrderPair pr1 = new OrderPair();
```

The statement will use the no-argument default constructor of *OrderPair*. The parentheses are necessary.

A reference variable may also be declared without having it refer to an instance right away. In such cases, it is good practice to initialize it to *null*:

```
OrderPair pr2 = null;
```

Finally, an array of references to *OrderPair* can be declared and initialized to an array of newly instantiated objects:

```
OrderPair pair[] = {
    new OrderPair(19,25), new OrderPair(-9,21),
    new OrderPair(37, -93), new OrderPair(-15, 72)
};
```

As in C or C++, array indexing always begins with *zero*.

The *this* Keyword in Java

In C++, the *this* keyword represents a *pointer* to the object doing the calling of a member function. In Java, the *this* keyword has a similar meaning, except the keyword represents a *reference* to the object doing the calling.

With respect to the *OrderPair* class, the *printXY()* method could be rewritten with the *this* keyword:

```
public void printXY() {
    System.out.println("(" + this.x + ", " + this.y + ")");
}
```

Of course, the use of *this* is not required for this example. However, there is an alternative way to use *this* in Java that is not available in C++:

```
public OrderPair() {
```



```
this(0,0);
}
```

The above means that constructor *OrderPair()* is using constructor *OrderPair(int, int)* with zeros for *x* and *y*. This scheme allows one constructor to handle all of the implementation details and have the other constructors call it.

Grouping Java Classes into Packages

The Java *package* can be thought of as a logical grouping of related classes. The classes need not be within the same class hierarchy. It is roughly equivalent to a C function library or a C++ class library.

The Java package allows the developer to (1) organize classes for specific purposes and (2) provide others the benefit of using what already has been developed. In order to re-use an existing class that belongs to a package, the *import* statement is used at the top of the source file, as in

```
import Animals.Humans.Person;
```

As a logical grouping, the package is actually related to a particular path and directory. All of the classes of the package are stored within that directory. To find the class of interest, Java employs a particular search mechanism to locate the package referenced by the *import* statement. There are three aspects to this scheme:

First, there is the environment variable *CLASSPATH*.

Second, there are one or more component package names. These component package names are concatenated together with the class name (with periods) to form the fully qualified class name:

```
package_comp_1.[package_comp_2].[package_comp_n].class_name
```

Third, there is the final component, the class name. An asterisk (*) in the last position would mean *all* classes of the package.

Let us look at each aspect, beginning with the environment variable *CLASSPATH*, which is set in different ways depending on the operating system you are using.

If you are using Windows/95 or Windows/NT 3.5 or higher, *CLASSPATH* can be set through the *Control Panel* utility. If you are using Windows/95, a statement such as the following can

be placed inside the *AUTOEXEC.BAT* file:

```
set CLASSPATH= .;C:\Java\Lib\classes.zip; C:\JAVAPAKS
```

A semicolon separates each possible path. The lone period (.) represents the current directory. The *.;C:\Java\Lib\classes.zip* portion is actually part of the initial setup of the Java Developer's Kit. The *classes.zip* file is part of the JDK and is a special condensation of all the standard Java packages.

The remaining clauses of *CLASSPATH*, such as *C:\JAVAPAKS*, are for the containment of user-defined packages.

The directory and path names are *not* case sensitive.

If you are using UNIX or HP-UX with the Bourne or Korn shells, the following line can be placed within the *.profile* turnkey file (or it can be entered via the command line):

```
CLASSPATH=/Java/Lib/classes.zip:/JAVAPAKS:.; export CLASSPATH
```

The directory, path, and file names in UNIX are *case sensitive*.

If you are using UNIX or HP-UX with the C shell, the following line can be placed within the *.cshrc* turnkey file (or it can be entered via the command line):

```
setenv CLASSPATH /Java/Lib/classes.zip:/JAVAPAKS:.;
```

The complete path to the class to be imported is a concatenation of a path clause from the *CLASSPATH* variable and the leading components of the package name. Suppose we are working from a Windows/NT environment (see *Figure 1*) and our classes are contained within the path

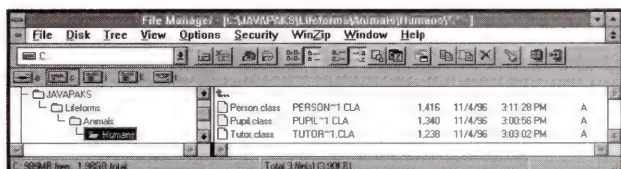
```
C:\JAVAPAKS\Lifeforms\Animals\Humans\
```

For this example, there are three classes within the package: *Person*, *Pupil* and *Tutor*.

The total package name will depend on how we select the paths for the *CLASSPATH* variable. This will also influence how the programmer will use the *import* statement within his Java source files. Suppose the programmer wanted to import class *Person*. *Table 2* shows the possible combinations.

To import all the classes (*Person*, *Pupil* and *Tutor*) of the package, he would use the asterisk (*) in place of a class name:

```
import Lifeforms.Animals.Humans.*;
```

FIGURE 1 Example Classes in Windows/NT**TABLE 2** Importing Combinations

CLASSPATH	PACKAGE NAME	IMPORT STATEMENT
C:\JAVAPAKS\	Lifefoms.Animals.Humans	import Lifefoms.Animals.Humans.Person;
C:\JAVAPAKS\Lifefoms\	Animals.Humans	import Animals.Humans.Person;
C:\JAVAPAKS\Lifefoms\Animals\	Humans	import Humans.Person;

or

```
import Animals.Humans.*;
```

or

```
import Humans.*;
```

for each of the three cases, respectively.

Introducing Inheritance

The notion of inheritance in object orientation denotes an "is-a" relationship. For example, a *Car* is a type of *Vehicle*. We say that class *Car* is a subclass (or derived class) of class *Vehicle*. Another way to express this relationship is to say class *Vehicle* is a superclass (or base class) of class *Car*. The act of subclassing is to take an existing class and to specialize it, either by overriding behaviors inherited from the parent or by adding new behaviors.

In C++, the *public* keyword is used to denote inheritance. In Java, the equivalent to *public* is the keyword *extends*:

```
class Car extends Vehicle {
...
}
```

Unlike C++, Java supports only single inheritance. In other words, a class can be extended from only one superclass. In addition, Java does *not* have anything such as private inheritance (something like *class Car : private Vehicle*) or virtual base classes (something like *class Car : virtual public Vehicle*).

Java does allow inheritance from an *interface*, which is a form of abstract class. We will look at interfaces a little later.

Another way Java differs from C++ is in the notion of modifiers being applied to a class. If we apply the *public* keyword to class *Car*:

```
public class Car extends Vehicle {
...
}
```

then all of the members will be visible to any class inside the package containing class *Car* or to any class outside of the package containing class *Car*.

If the *public* keyword is omitted, the members of class *Car* will be visible only to classes within the package that contains *Car*. This is the *default* visibility level for a class. Classes that are members of other packages have no visibility to the members of *Car*. It is important to remember that the *lack* of a modifier means visibility from within the package.

The *private* and *protected* keywords cannot be applied as modifiers of a class.

Applying Java Modifiers to Fields and Methods

The rules governing access to members of a class are more complicated in Java than in C++. It is basically a combination of the visibility modifiers at the class level and access modifiers at the member (field and method) level. In terms of keywords that are in common with C++, we have the following Java modifiers: *private*, *private protected*, *protected*, *public*, and the default (the lack of a keyword).

When it comes to the ability to access a member, the following dimensions must be kept in mind: (1) subclasses versus non-subclasses (i.e., classes belonging to another part of the class hierarchy which have no lineage to the class in question), (2) access to the method through inheritance or through an instance, (3) access to the methods of classes that

reside within the package of the class in question or outside of the package of the class in question.

In the previous example with class *OrderPair*, we have seen the use of the *private* and *public* modifiers on its members. A private member is accessible only to methods of the same class. Furthermore, private members cannot be inherited by subclasses. On the other hand, a public member certainly can be inherited by subclasses of the same package or by subclasses from a different package and public members can be accessed through instances of the class by methods of subclasses or non-subclasses, whether these classes are in the same or a different package.

Now, what about *private protected* and *protected*? Surprisingly, the Java *protected* keyword does not carry the same meaning as the C++ *protected* keyword! Rather, the Java *private protected* keyword combination (or *protected private*) comes closest in semantics to C++ *protected*. These differences are best understood with a few examples. Suppose we have the code in *Listing 3*. The execution of that Java code would produce:

```
Name = Wes
SSN = 570-45-1287
Gender = M
Age = 17
Name = Yvonne
SSN = 630-22-0980
Gender = F
Age = 22
School = Univ. of Washington
Level = 3
Name = Yvonne
SSN = 630-22-0980
Gender = F
Age = 23
School = Univ. of Washington
Level = 3
```

The boldfaced code contains the main points of the example.

The Java *private protected* members, whether they are fields or methods, can be inherited by the subclasses of the base class. The subclasses may be in a package different from the package containing the parent class.

In the example, class *Pupil* inherits methods *getAge()* and *setAge()* from class *Person* and accesses these methods in the body of its *incrementAge()* method.

Like C++ *protected* members, Java *private protected* members cannot be accessed through client code. For instance, class *InheritDemo1* has no direct relationship to the *Person-Pupil* hierarchy. If its public static *main()* method contained the statement

```
yvonne.setAge(30);
// Illegal! Person.setAge() is private protected.
```

the compiler would flag this as an error.

In addition, the methods of a derived class cannot access the *private protected* members of the superclass through instances of the superclass. For example, if class *Pupil* included the following method:

```
void adjustAge(Person individual, int new_age) {
    individual.setAge(new_age);           // Illegal!
}
```

the compiler would flag the statement *individual.setAge(new_age);* as an error because *individual* is a reference to a *Person* object. However, if *individual* represented a *Pupil* or a subclass of *Pupil*, then the statement would be legal. In summary, this behavior is equivalent to a protected *Pupil::adjustAge(Person &, int)* counterpart in C++.

Now that we understand the meaning of *private protected*, what is the meaning of *protected* in Java? Suppose we make selective changes and additions to the *Person* and *Pupil* classes shown in *Listing 4* (unchanged statements are not listed). Changes or additions to the previous example are boldfaced. The execution of *RunInheritDemo2.main()* would yield the following:

```
Name = Wes
SSN = 570-45-1287
Gender = M
Age = 17
Name = Wes
SSN = 570-45-1287
Gender = M
Age = 20
Name = Yvonne
SSN = 630-22-0980
Gender = F
Age = 22
```

LISTING 3 *Applying Modifiers*

```
// Source file: Person.java
package Humans;
import java.awt.*;
import java.io.IOException;
public class Person {
    public Person(String nm, String id, char sx, int yrs) {
        name = new String(nm);
        ssn = new String(id);
        gender = sx;
        age = yrs;
    }
    public void DisplayData() {
        System.out.print("\n\nName = "+name);
        System.out.print("\nSSN = "+ssn);
        System.out.print("\nGender = "+gender);
        System.out.print("\nAge = "+age);
        System.out.flush();
    }
    private protected int getAge() {
        return age;
    }
    private protected void setAge(int yrs) {
        age = yrs;
    }
    private String name;
    private String ssn;
    private char gender;
    private int age;
}

// Source file: Pupil.java
package Humans;
import java.awt.*;
import java.io.IOException;
public class Pupil extends Person {

    public Pupil(String nm, String id, char sx, int yrs, String sc, int lv) {
        super(nm, id, sx, yrs); // Call Person(String, String, char, int);
        school = new String(sc);
        class_level = lv;
    }
    public void DisplayData() {
        super.DisplayData(); // Call Person.DisplayData();
        System.out.print("\nSchool = "+school);
        System.out.print("\nLevel = "+class_level);
        System.out.flush();
    }
    public void incrementAge() {
        int curr_age = getAge();
        setAge(++curr_age);
    }
    private String school;
    private int class_level;
}

// Source file: InheritDemo1.java
import java.awt.*;
import java.io.IOException;
import Humans.*;
public class InheritDemo1 {
    public static void main(String args[]) {
        Person wes = new Person("Wes", "570-45-1287", 'M', 17);
        wes.DisplayData();
        Pupil yvonne = new Pupil("Yvonne", "630-22-0980", 'F', 22, "Univ. of
                                Washington", 3);

        yvonne.DisplayData();
        yvonne.incrementAge();
        yvonne.DisplayData();
    }
}
```


LISTING 4 *Protected Keyboard*

```
// Source file: Person.java
package Humans;
import java.awt.*;
import java.io.IOException;
public class Person {
    // The constructor and DisplayData() are unchanged
    protected int getAge() { // Formerly private protected
        return age;
    }
    protected void setAge(int yrs) { // Formerly private protected
        age = yrs;
    }
    // Private fields are unchanged
}

// Source file: Pupil.java
package Humans;
import java.awt.*;
import java.io.IOException;
public class Pupil extends Person {
    // The constructor, DisplayData() and incrementAge() are unchanged
    public void adjustAge(Person individual, int new_age) {
// New method
    individual.setAge(new_age); /* (1) */
    }
    // Private fields are unchanged
}

// Source file: InheritDemo2.java
package Humans;
import java.awt.*;
import java.io.IOException;
public class InheritDemo2 {
    public static void main(String args[]) {
        Person wes = new Person("Wes", "570-45-1287", 'M', 17);
        wes.DisplayData();
        wes.setAge(20); /* (2) */
        wes.DisplayData();
        Pupil yvonne = new Pupil("Yvonne", "630-22-0980", 'F', 22, "Univ. of Washington", 3);

        yvonne.DisplayData();
        yvonne.setAge(30); /* (3) */
        yvonne.DisplayData();
    }
}

// Source file: RunInheritDemo2.java
import java.awt.*;
import java.io.IOException;
import Humans.*;
public class RunInheritDemo2 {
    public static void main(String args[]) {
        InheritDemo2.main(null);
    }
}
```

```
School = Univ. of Washington
Level = 3
Name = Yvonne
SSN = 630-22-0980
Gender = F
Age = 30
School = Univ. of Washington
Level = 3
```

The *protected* keyword modifier has all of the capabilities of the *private protected* modifier. However, unlike the Java *private protected* modifier, the *protected* methods of class *Person* are accessible through instances of *Person* within methods of subclasses (see */* (1) */*). In addition, the *protected* methods may also be accessible through instances of *Person* (or subclasses of *Person*) from methods of unrelated classes (see */* (2) */* and */* (3) */*). For statements with comments */* (2) */* and */* (3) */* to be legal, class *InheritDemo2* must reside in the same package as class *Person* (they are both members of package *Human*).

As in the case for *private protected* members, a subclass can belong to a package different from the package of its superclass and still inherit the *protected* members of the superclass.

The default modifier (no keyword) for a member provides the same level of capabilities as *protected*, but subclasses belonging to a different package cannot inherit the members of the superclass.

Dynamic Method Lookup

Polymorphism is the ability of an object to respond appropriately to a message based on its type and position on the class hierarchy. By responding appropriately, we mean the ability of the object to choose the method implementation that best suits its capabilities. In C++, polymorphism is implemented by specifying certain member functions as *virtual*. In Java, there is no keyword like *virtual*. Polymorphism is simply a default feature of classes.

If we go back to the earlier example with base class *Person* and derived class *Pupil*, each of these classes has its own *DisplayData()* implementation. If we have a statement such as

```
Person paula = new Pupil("Paula", "636-37-0740", 'F',
                        22, "Univ. of Chicago", 4);
```

followed by

```
paula.DisplayData();
```

which *DisplayData()* would be called, *Person.DisplayData()* or *Pupil.DisplayData()*? The answer is *Pupil.DisplayData()* because all Java classes inherently have a virtual dispatch mechanism to locate and match the implementation to the type of the object. Variable *paula* is a reference to a *Person*, but the object it refers to is of type *Pupil*.

Abstract Classes in Java

All of the previous classes we have seen are *concrete* classes, meaning that it is possible to create instances of the classes. Another type of class called an *abstract* class contains the names of behaviors without the implementations to execute those behaviors. Objects cannot be instantiated from an abstract class.

One of the objectives of good object-oriented programming is to recognize the elements that are in common and to group those elements into general abstractions. For instance, if I were to construct a framework of classes for geometric shapes, I might start with the general notion of a shape as the base class. From this base class, I would derive specific shape classes, such as *Circle* or *Rectangle*.

One of the things I might do in the design of the framework is to have a unique *id* assigned to each *Shape* object upon instantiation. At times, I would need to get the *Shape* object's *id*, so a method such as *getId()* would be declared and implemented for class *Shape*.

In addition, there is the notion of an area that can be calculated from any *Shape* object. However, the formula to calculate an area varies from one specific shape to another. In this case, a method prototype such as *getArea()* would be included in the body of class *Shape* and it would be up to the derived classes, such as *Circle* and *Rectangle*, to provide the specific implementations. *Listing 5* shows an example in Java. The execution of the code would output:

```
cir1 has id = 1, area = 706.858
rect1 has id = 2, area = 22000
shapel has id = 1, area = 706.858
shapel has id = 2, area = 22000
```

In C++ an abstract member function is declared as *virtual* and tagged with "*=0*" immediately after the argument list (called *pure virtual functions*). Java, on the other hand, uses the keyword *abstract*:

LISTING 5 *Geometric Shapes*

```

import java.awt.Point;
abstract class Shape {
    public Shape() {
        id = ++count;
    }
    public int getId() {
        return id;
    }
    public abstract double getArea();           /* (1) */
    private static int count = 0;
    private int id;
}

class Circle extends Shape {
    public Circle(int x, int y, int rad) {
        center = new Point(x, y);
        radius = rad;
    }
    public double getArea() {
        return 4 * Math.atan(1.0) * radius * radius;    // pi == 4 * atan(1.0)
    }
    private int radius;
    private Point center;
}

class Rectangle extends Shape {
    public Rectangle(int ul_x, int ul_y, int lr_x, int lr_y) {
        upperLeft = new Point(ul_x, ul_y);
        lowerRight = new Point(lr_x, lr_y);
    }
    public double getArea() {
        double result = Math.abs(upperLeft.x - lowerRight.x) * Math.abs(upperLeft.y - lowerRight.y);
        return result;
    }
    private Point upperLeft;
    private Point lowerRight;
}

public class ShapeDemo {
    public static void main(String args[]) {
        Circle cir1 = new Circle(7, 9, 15);
        System.out.println("cir1 has id = " + cir1.getId() + ", area = " + cir1.getArea());

        Rectangle rect1 = new Rectangle(-50, 70, 150, 180);
        System.out.println("rect1 has id = " + rect1.getId() + ", area = " + rect1.getArea());

        Shape shape1 = cir1;           /* (2) */
        System.out.println("shape1 has id = " + shape1.getId() + ", area = " + shape1.getArea());

        shape1 = rect1;                 /* (3) */
        System.out.println("shape1 has id = " + shape1.getId() + ", area = " + shape1.getArea());
    }
}

```

public abstract double getArea();

In this case, the keyword *abstract* serves as a modifier to method *getArea()*. As in C++ classes, the presence of at least one abstract method will make the whole class abstract. When a class contains at least one abstract method, the *abstract* mod-

ifier must be applied to the class declaration:

abstract class Shape

As in C++, one may not create instances of abstract classes. For example, the following would be illegal:

```
Shape shape_obj = new Shape();    // Error!
```

As mentioned earlier, Java methods are *virtual* by default. In other words, a Java object, based on its type and position in the hierarchy, will be able to invoke the correct implementation of a method. In the above (see /* (2) */ and /* (3) */, reference variable *shape1* may refer to any subclass of *Shape* at any given time. However, because of dynamic binding, *shape1* will exhibit the correct response when message *getArea()* is sent to it.

When a derived class overrides an abstract method and provides an implementation, it must do so with the same method name, argument list, modifiers, and return type. A derived class that does not provide an implementation to an inherited abstract method must be declared as an abstract class.

As in C++, an abstract class can have non-abstract methods. The *getId()* method of abstract class *Shape* is a non-abstract method.

Java Interfaces

One of the major differences between C++ and Java is how inheritance is supported. C++ supports multiple inheritance while Java does not. The designers of Java realized that multiple inheritance as implemented by C++ was too controversial and too complicated to be used safely and hence decided to refrain from putting these features into Java. Instead, Java has a feature called *interfaces*, which permits the inheritance of method prototypes from multiple sources.

A Java *interface* is just like an abstract class in that one cannot instantiate an object from an interface. Unlike the abstract class, an interface can only have method prototypes, no variables. However, one may declare a reference variable of an interface type and such variables may be fields inside classes.

Whenever a class *implements* one or more interfaces, the class can provide an implementation for each method prototype of each interface. If there is one inherited method prototype that is not implemented, then the class must be declared *abstract*.

One of the unique aspects of Java is that the language comes with support for multithreaded programming (which Sun Solaris 2, Microsoft Windows/NT, and POSIX 1003.4a environments support). A standard Java interface to support this type of programming is called *Runnable*. Interface *Runnable* has a single method prototype called *run()*:

```
public interface Runnable extends Object {
    public abstract void run();
}
```

Listing 6 shows a class called *DatetimeDemo* that implements *Runnable*. The *main()* method of *DatetimeDemo* spawns two cooperating threads each of which displays its name and the current date and time for a given number of iterations. A sample display on the standard output device would look like

```
Thread 1: Fri Jan 17 00:10:07 1997
Thread 2: Fri Jan 17 00:10:07 1997
Thread 1: Fri Jan 17 00:10:07 1997
Thread 2: Fri Jan 17 00:10:07 1997
Thread 1: Fri Jan 17 00:10:08 1997
Thread 2: Fri Jan 17 00:10:08 1997
Thread 1: Fri Jan 17 00:10:08 1997
Thread 2: Fri Jan 17 00:10:08 1997
Thread 1: Fri Jan 17 00:10:08 1997
Thread 2: Fri Jan 17 00:10:08 1997
Thread 1: Fri Jan 17 00:10:08 1997
Thread 2: Fri Jan 17 00:10:08 1997
Thread 1: Fri Jan 17 00:10:09 1997
```

Appearing on the Horizon

For the experienced C++ programmer wishing to go to Java, I have introduced a number of fundamental Java keywords and constructs. Unfortunately, because of space limitations, I cannot elaborate much more. The Java language has many more features—runtime type information (RTTI) and exception handling to name two. RTTI is a feature to help identify the type of an object during runtime, which is useful for determining whether an object can handle a certain message. Exception handling is a mechanism to help the developer write more reliable code. Many of the standard Java classes use exception handling. Contemporary C++ also has equivalents to these features. For the enthusiastic reader, I have provided a list of references.

As a development environment, the Java Developer's Kit includes a number of important packages that are not part of the Java language itself. One package includes network support for URLs (Uniform Reference Locators) and sockets. Another package is the Abstract Window Toolkit (AWT), which provides a set of platform-independent user interface components and protocols.

At the time of this writing, SunSoft is gearing for the future Java 1.1 release and has presented a host of new packages and enhancements for public review. Some of the new features include support for internationalization, applet security, dis-

LISTING 6 *Implementing Runnable*

```

import java.util.Date;
import java.io.IOException;
class DatetimeDemo implements Runnable {
    DatetimeDemo(String str, int max) {
        name = str;
        count = max;
        xpath = new Thread(this); // Construct the new thread with the calling object
                                   // Uses constructor Thread(Runnable)
        xpath.start(); // Put the new thread into the runnable state
    }
    Thread getThread() {
        return xpath;
    }
    public void run() { // This method is transparently called by start()
        while (count-- > 0) {
            System.out.println(name+": " + new Date());
            try {
                Thread.sleep(200); // Make the current active thread sleep
                                   //for 200 milliseconds
            }
            catch (Exception err) {
                System.out.println(err.toString());
                System.exit(-1);
            }
        }
    }
    private String name;
    private Thread xpath;
    private long count;
    public static void main(String args[]) { // Start of the primary thread
        DatetimeDemo dt1 = new DatetimeDemo("Thread 1", 7);
        DatetimeDemo dt2 = new DatetimeDemo("Thread 2", 7);
        // Make the primary thread block until all the
        //secondary threads complete execution
        while ((dt1.getThread().isAlive()) || (dt2.getThread().isAlive()));
    }
}

```

tributed computing (remote method invocation), and interfaces to relational databases (Java Database Connectivity). The totality of these features promises to make enterprise-wide computing available throughout the world. For the diligent software professional, it means new career opportunities never before imagined.

It is rare that a software technology gathers public enthusiasm and momentum so quickly. In a matter of less than a year since its formal release, Java has done exactly that. Coffee brewing has never been more exciting. ■

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- Just Java* by Peter van der Linden (Sunsoft Press/Prentice Hall)
- Java by Example* by Jerry Jackson and Alan L. McClellan (Sunsoft Press/Prentice Hall)
- Core Java* by Gary Cornell and Cay S. Horstmann (Sunsoft Press/Prentice Hall)
- Java in a Nutshell* by David Flanagan (O'Reilly and Associates, Inc.)
- The Annotated C++ Reference Manual* by Bjarne Stroustrup (Addison-Wesley)

Interesting Web Sites

- <http://www.sun.com/>
- <http://java.sun.com/>
- <http://www.hp.com/gsyinternet/hpjdk/>
- <http://www.javaworld.com/>
- <http://www.gamelan.com/>



by David L. Totsch

How Are Things Going?

THIS MONTH BEGINS A SERIES of columns dedicated to training HP-UX how to monitor its own status and report on an exception basis. A chief criticism of UNIX in general has been the lack of tools to monitor a system. The only response to such a criticism is to remind the critic that UNIX systems are more different than they are the same—even when they are the same version on identical hardware. Users bought into UNIX precisely for such flexibility. Therefore, the tools that will be described may or may not apply to your particular environment. The ideas and concepts presented, however, might prove applicable to any environment. Here are the general categories you should see over the coming months:

- Maintenance of btmp and wtmp
- Monitoring System Logs (syslog)
- General Log File Reporting and Truncation
- Maintaining IPCS
- Disk Space Monitoring

As we cover this list, HP-UX 9.x will be ignored. Since that sounds a little callous, most of what will be discussed will have a primary difference of location (where files and commands are in the file tree). Using a quick *case* statement on *uname -r* to set some appropriate variables should gain access for 9.x users. Besides, I promise to do my best to warn 9.x users when I have done something 10.x-specific. In that spirit, let's begin this month by examining a topic that lacks a version-specific solution: Disk Space Monitoring.

First of all, we need a list of local file systems. We need to avoid any NFS mounts since we have enough aggravation without generating redundant reporting. Here is the shell code:

```
bdf -l 2>/dev/null | awk '$1 !~ /Filesystem/ { print $NF }'
```

Um, well, it reports the mount point, not the file system, but that is OK. Moreover, you may be asking, Why go to all of that trouble? If you have long file system or mount point names, those entries will take up two lines.

One other item we might want to ignore are mounted CD-ROMS; their size is always 100 percent full. Here is the shell code to get the CDFS mounts:

```
bdf -t cdfs 2>/dev/null | awk '$1 !~ /Filesystem/ { print $NF }'
```

Now we have to separate the CDFS mount points from the local file systems. If the locals are in the variable *LOCALLIST* and the CDFS's are in *CDFSLIST*, then the following code will leave us with what we want:

```
print "${LOCALLIST}\n${CDFSLIST}" | sort | uniq -u
```

This has no side effects if you run it on a system that does not have any CDFS file systems. Once the list is sorted, *uniq -u* prints only lines that are not repeated.

Seems like a lot of effort so far and we have only the list of mount points we want to report on. What we need to do now is run a *for* loop on this list. Within that loop we need to capture and test the *bdf* output for each mount point. Here is the data capture:

```
bdf -i ${MOUNTPPOINT} 2>/dev/null | grep -v "^Filesystem" | \
paste - - | read FS V W X CAP Y Z INOD MP
```

Here is the description: the backslash (\) at the end of the first line is to instruct the shell to ignore the line-feed (to continue the command on the next line); the *bdf -i* includes the inode information; the *paste - -* makes sure that two-line reports are on one line; the *read* captures the file system name in *FS*, the capacity (amount used as a percentage) in *CAP*, the inode capacity (amount used as a percentage) in *INOD*, and the mount point name in *MP*—everything else is ignored.

If the threshold for reporting capacity is in *CAPTHRESH*, then this code would be used to check the capacity against the threshold:

```
if [[ ${CAP%*%} -gt ${CAPTHRESH} ]]
```

No, the typographer did not make a mistake, *`\${CAP%*%}`* is correct. Other than the obvious *print* statement used earlier, this is the first Korn/POSIX shell-specific code that has been used. The first percent symbol instructs the shell to begin matching the end of the contents of *CAP* for truncation. The **%* matches the percent sign in the data. Basically, we end up with the percentage number without the percent notation. Do not forget to test the inode information in a similar fashion. While the script has this data, you might want to append it to a handy file somewhere for historical logging.

When the data is outside of the threshold, you will want to report it somehow. You can use the native e-mail system as an effective means of reporting. I suggest creating a mail alias if you have more than one system administrator. If you have installed software to drive a pager, you would build in that interface. As an alternate method, you can use the system logging facility *logger*. Using the system logging facility will allow you to consolidate all messages into a single report; you can even route all messages to a central host. But, leveraging the system logging facility is part of a topic that we will pick up later.

How often you run this report depends on the current state of your environment. If file systems seem to fill up

suddenly, you may want to run it fairly often. If you run it often, be sure to code in a mechanism to prevent multiple reporting (like touching a file in a directory and removing it when the file system drops below the threshold). Otherwise, a daily run will probably suffice (remember, you are looking for a reporting threshold, not 100 percent full). Quite a bit more complex, but still possible, would be to have a data file with a separate threshold for each mount point (be sure to code a default for mount points that do not appear in the list or at least report that they do not have a threshold).

Reporting file system full is a basic task that all system administrators have to fulfill, even if it is eyeballing a *bdf* once in a while. I am all for making the system take care of these types of tasks itself. I avoided including the complete shell script because I want you to have the practice of writing the shell script. Since your site is unique, you have a strong likelihood of needing a customized shell script. Those of you who need the shell script writing practice have enough to get you going; for those who do not, maybe these scripts we will discuss over the next few months will appear on the HP World '97 Swap Tape. ■

David L. Totsch is a Technical Consultant for Premier Systems Integrators, Inc. in Charlotte, North Carolina. His specialty is HP-UX system administration and he enjoys training others to do the same. He can be reached at (704) 522-6088 or totsch@rbdc.rbdc.com.



HP-UX Systems Administration

by Chris Curtin

A 10.10 Grab-bag

THIS MONTH I PRESENT a grab-bag of information, little things I have noticed or implemented in HP-UX 10.10, all of which should work (or apply) to later versions.

HP-UX Start-up and Shutdown

I was going to write a whole column on the new start-up and shutdown scheme HP implemented in 10.10, but John Fenwick beat me to it in the January 1997 issue. The only advice I can add to his article is that it is really easy to create your own start-up and shutdown scripts for your applications. I have created scripts for Oracle, FlexLM license Manager, our HTTPD server, and several custom applications.

Copy the `/sbin/init.d/cron` and the `/etc/rc.config.d/cron` files and use them as a starting point. Also, don't forget to create symbolic links to the `/sbin/init.d` directory instead of copying the files.

Sendmail Changes in HP-UX 10.X

HP's version of sendmail changed quite a bit in 10.X. The basic functionality remained the same, but the configuration files and executables are in a new home.

First, HP has split off the sendmail configuration into its own directory, `/etc/mail`. I think this makes more sense than having it in `/usr/lib` as in 9.x. There are four main files in this directory: `aliases`, `mailcap`, `rev-aliases` and `sendmail.cf`. These are the files you can modify. There are several others, all ending in `.dir`, `.pag`, or `.fc`. You can ignore them. They are binary versions of the four main files.

`sendmail.cf` is the configuration file for sendmail's routings. Basically unchanged from 9.x, it does include a rule for passing unresolved SMTP ('@'-

style addresses) to the SMTP relay via UUCP. Long time readers will remember I struggled with this for a couple of days before figuring out how to do this. HP's solution is more elegant, but achieves the same purpose.

The `mailcap` file is an undocumented look-up list of applications for viewing the various attachments to e-mail messages. It supports most of the standard image types, including jpeg, rich text, gif, etc. I'm still doing research into the use of this file, so I'll write about it in a future column.

The `aliases` file is the same as for 9.x. It contains a list of e-mail aliases for your site. It can be used to alias all the various 'helper' accounts, such as uucp, daemon, and operator, to the root account. It also allows you to create simple aliases for a whole company or group of users. After modifying this file, don't forget to run `/usr/sbin/newaliases` to make the aliases active.

A new twist, which makes user account hiding much easier, is the `rev-aliases` file. Basically, `rev-aliases` allows you to specify an alias for a user for all outbound e-mail, typically `first_last` or `first.last`. Most security experts recommend not using users' login names as their e-mail address. The major reason is that it gives a cracker some place to start. It is also helpful in academic or large companies where an e-mail address is a number. For example, user John Smith has an account name of `a12345`. Now, I wouldn't expect anyone to remember this, since it was probably computer generated, so I add an entry to `rev-aliases` like this:

```
a12345: John_Smith
```

or

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a12345: John.Smith

This way, e-mail from John is delivered as 'John_Smith@yourdomain.com' instead of 'a12345@yourdomain.com'. Also it makes it easier for users to remember how to send mail to John or any of your other users. It is always 'First_Last@yourdomain.com'.

Now that's great for outbound, but how does the inbound mail get to John? Use the aliases file. Add a line like this:

John_Smith: a12345

or

John.Smith: a12345

Again, remember to run `/usr/sbin/newaliases` after modifying either the `rev-aliases` or `aliases` files.

General 10.10 Issues

Contrary to what was written in several newsgroups and mailing lists, `/etc/securetty` does work on 10.10. Remember that `/etc/securetty` allows you to define what terminals can be used for direct login as root. Apparently this did not work on 10.00, but it works now. Also, `xm` and `vuelogin` have been changed to look at this file. Get the latest patches for the X environment to get the update. You'll remember that in 9.x you had to modify some Vue scripts to do this.

Want to see something really interesting? Copy `/etc/passwd` from your 9.x system after upgrading/installing 10.10. Now try to log in. Boom. No `/users` directory! Also, the shells for all your users probably reference the old `ksh`, `sh`, or `csh`. What you need to do is reboot into single user mode and edit `/etc/passwd`

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using *vipw*. Change all the */users* directories to */home* and the */bin/[kc]sh* to */usr/bin/[kc]sh*.

I recommend installing 10.10 instead of upgrading a 9.x system. Plan the upgrade, paying special attention to the new disk layout, then completely install, overwriting your current disks. Trust me, it'll save a lot of problems later. In the 'why did they change that?' category: *cu* now defaults to 300 baud unless you explicitly list a speed using the *-s* option. In previous HP-UX versions, *cu* found the first entry for the system you were calling in */usr/lib/uucp/Systems* (which is now located in */etc/uucp/Systems*) then used that speed. Now it defaults to 300 and complains it cannot find the System. Or, if you specify a baud rate not defined for the system, it also complains. In previous versions, it again used the first entry. It's not that difficult to remember, but if you get paged at 3 a.m. on a Saturday, this quirk is not the first thing that comes to mind.

Moved files: In 9.x */etc/newconfig* held all the template configuration files. In 10.10 this is moved to */usr/newconfig*. Same files, different location.

Want to know what software/filesets are installed on your system? In 9.x and earlier you could look at */etc/filesets* or */system*. In 10.10, with the introduction of *swinstall* and friends, all this information has been moved to */var/adm/sw*. Now instead of one directory, there are several:

products—list of install filesets and packages
patch—list of install patches, including the original files they replaced
patch/.SUPERSEDED—list of patches superseded by the installed patches.

There are also a few files of note: *PATCH.log* contains the list of patches

actually installed. This list is often different from the list in the patch directory because the patch directory is not cleaned up when a new patch that supersedes an old patch is installed. The file-set information for the old patch is still located in this directory. The *patch/.SUPERSEDED* directory lists what patches were superseded, but at a quick glance you can't tell what you have. *PATCH.log* lists each installed patch and only those that are currently active.

The second file is *.codewords*, which lists the codewords, by CD-ROM, used to install your system. I recommend e-mailing this information to yourself or making a hardcopy and keeping it separate from the list HP supplied. Too many times I couldn't find the HP list or didn't have access to it. I usually have the code-words, along with the license certificates, locked in the company's safe. At 6 a.m. the office manager isn't around.

Finally, I want to go on a rant. I know it's been a while since I did this, but HP's cabling scheme for muxes on the D-350 is absurd. Those with the cat o' nine-tails muxes know what I am ranting about. Instead of supplying a standard, DB-25 mux with the D-350, you get this 8-headed cable with RJ-45-like connectors. I say 'like' because it's not an RJ-45. It is some bizarre 10-pin ribbon cable connector. Now HP sells you bizarre to DB-25 cables, but they are expensive and the HP order form didn't recommend them when you got the mux. I had to get Black Box Corp. to make me several to get my modems connected.

What is the deal here? In the 'olden' days, HP required E Series muxes to have special pin-outs on their DB-25 cables. Again, custom built modem cables. At least the simple terminal cables with 2-3-7

worked. Now I need to buy special bizarre to RJ-11 and RJ-45 cables because the transmit and receive wires on the bizarre connections are not 2 and 3.

Okay, end of rant. Anyone else found any new and interesting features in HP-UX 10.x you want to know more about? Send me some e-mail and I'll write about it. ■

Christopher Curtin is the Team Lead for Server-side Client-Server development for Manhattan Associates. His e-mail address is ccurtin@mindspring.com.

Stuck using tar?

(or fbackup, cpio, or dump?)

What a sticky mess! Standard UNIX backup utilities force you to glue on scripts to make them work right, have performance like molasses, user interfaces that are clear as pitch, and reliability that could drag your career down into a pit. It's time to kick asphalt. Load BACKUP/9000 (it takes less than 10 minutes), and automate super fast, reliable backups and restores on any networked system via its slick user interface. Let BACKUP/9000 back up your Oracle databases hot, track tapes and files, manage media, schedule backups, etc. Don't get stuck - get something faster, easier, and more reliable. Contact us for a free demo today, before things get really messy.



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CIRCLE 72 ON READER SERVICE CARD

by Joseph Berry

IN THIS MONTH'S COLUMN, I discuss a couple of interesting Usenet news-readers as well as some security/privacy tools that you should be aware of. I had never heard of *ssh* (the "Secure Shell") until my friend Harlen Stenn mentioned it to me. Then, suddenly, I found two articles in magazines that referred to the same program.

Being in the UNIX community is wonderful. People share information and software with one another—useful information, good software. I hope I contribute a little by referencing these packages that software authors have shared. If you are looking for a particular program or utility that you think might be of interest to other people, let me know. I will dig around. You never know what you might find.

MISC

ssh v 1.2.17

Many people access computers on the Internet via telnet. Either they are working at home and need to access the company computers or they are at one company site and need to access the computers at another location. While very convenient and productive, it is also prone to attack by a malicious hacker. When connecting to the remote site, you enter your user name followed by your password. Both of these fields are sent from your computer to the remote computer as clear text, readable by anyone. And who can read it? With the proper software on the proper hardware, your password can be read by anyone on your local network, on the network of your Internet provider, or on the network of the remote site's Internet provider. And, unfortunately, many passwords have

been hacked in this manner.

ssh stands for the secure shell, a program written by Tatu Ylonen (ylo@cs.hut.fi). This program logs into another computer over an untrusted network and provides for the remote execution of commands. The program features strong authentication, privacy via RSA, DES and other encrypting algorithms, and secure X11 sessions. To use *ssh*, you must have an *sshd* daemon program running on the computer you wish to connect to. You connect to that computer by typing "ssh host-name." This program comes highly recommended.

ssh is available at [ftp.cs.hut.fi](ftp://ftp.cs.hut.fi/pub/ssh) in the */pub/ssh* directory. Be sure to look in the contrib directory as there are some HP-specific files you need to download.

pgp 2.6.2

pgp is one of the most famous programs available on the Internet. It has been mentioned in many magazines and newspapers including *The Wall Street Journal*. Developed by Phil Zimmerman, *pgp* ("Pretty Good Privacy") is a program that encrypts and decrypts messages. It is based on RSA public-key encryption technology, making it, unfortunately, illegal to export and use outside of the United States (although work is under way to rectify this). *pgp* includes a sophisticated key management subsystem as well as message digests for digital signatures.

The advantage of using public-key encryption is clearly explained by Zimmerman (from his file *doc/pgp-doc1.txt*): "In conventional cryptosystems, such as the U.S. Federal Data Encryption Standard (DES), a single key is used for both encryption and decryption. This means that a key must be initially trans-

mitted via secure channels so that both parties can know it before encrypted messages can be sent over insecure channels. This may be inconvenient. If you have a secure channel for exchanging keys, then why do you need cryptography in the first place?

"In public key cryptosystems, everyone has two related complementary keys, a publicly revealed key and a secret key (also frequently called a private key). Each key unlocks the code that the other key makes. Knowing the public key does not help you deduce the corresponding secret key. The public key can be published and widely disseminated across a communications network. This protocol provides privacy without the need for the same kind of secure channels that a conventional cryptosystem requires.


"Anyone can use a recipient's public key to encrypt a message to that person, and that recipient uses her own corresponding secret key to decrypt that message. No one but the recipient can decrypt it, because no one else has access to that secret key. Not even the person who encrypted the message can decrypt it."

pgp is available from a number of sites, most notably MIT. In addition, a popular location for the sources is from the following site:

<http://www.ifi.uio.no/pgp/modules.shtml>
<ftp://ftp.ifi.uio.no/pub/pgp/lang/>

mv 6.5.1

One of the most fascinating features of the Internet is Usenet. Usenet is composed of over 20,000 different newsgroups, where users interact with their newsgroups of interest in a bulletin



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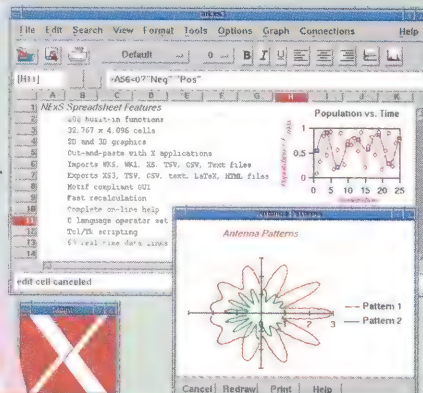
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board system manner. Newsgroup topics include computer-oriented as well as science-oriented technical subjects. As I have previously mentioned, the sources for this column come from either actual source code posted on a newsgroup or from announcements and discussions about some particular piece of software.

So how does a person actually read the postings from the newsgroups of interest? With a Usenet newsreader, of course. Many good free newsreaders are available. Some offer a more user-friendly front-end at the expense of having less powerful features while some (see *gnus* below) are very powerful but encourage you to learn a text editor in addition to the newsreader to get the most out of its tool. Please note that having this software is not sufficient for accessing Usenet. You also need access to a computer that maintains the Usenet database.

nn is a menu-based newsreader that presents the user with screens of news messages. You choose which messages you want to read, proceeding from screen to screen, newsgroup to newsgroup. You can easily subscribe to new newsgroups by classes (for example, I want to subscribe to all newsgroups that start with "comp."). *nn* includes enough features to satisfy both the expert and the novice user. The software includes online help as well as a manual. Keystrokes can be remapped to other keystrokes with *nn*'s advanced macro definition features.

A large following exists for this software package and it even has its own newsgroup (*news.software.nn*). The software is available via anonymous ftp from *ftp.isca.uiowa.edu* in

directory */9/unix/nn/nn-6.5* as file *nn-6.5.1.tar.gz*.

gnus v 5.4.9 and rgnus v 0.84

gnus and its latest incarnation, *rgnus*, are emacs-based news readers. You must (or at least should) know the text editor, emacs (to some extent), to take advantage of these readers. A wealth of options are available with both of these programs and you might feel a bit overwhelmed the first time you look at the documentation or run the program. I found, however, that if you take advantage of emacs' pull-down menus that are *gnus*-specific, you will see and learn the essential commands that you need to know.

Which package should you use? I'm not really sure. *gnus* is a rewrite of an older *gnus* (version 4.1 by Masanobu Umeda) by Lars Magne Ingebrigtsen (*larsi@ifi.uio.no*). *rgnus*, also called Red Gnus, is written by the same author. It appears that this module is a rewrite of *gnus* Version 5. Although it is currently still in "alpha" release, I am using the product without any difficulties. *rgnus* is completely compatible with *gnus*. Ingebrigtsen writes that *rgnus* "... will let you look at just about anything as if it were a newsgroup. You can read mail with it, you can browse directories with it. ... (R)Gnus tries to empower people who read news the same way emacs empowers people who edit text."

Sources to both packages are available from *ftp.ifi.uio.no* in the */pub/emacs/gnus* directory. Other locations include *ftp.pilgrim.umass.edu* (in directory */pub/misc/ding*) and *aphrodite.nectar.cs.cmu.edu* (in directory */pub/ding-gnus*).

trace v 1.6

In early 1995 I mentioned a program called *trace* (Version 1.3) that had been developed by Kartik Subbarao. Unfortunately, at the time it only supported HP-UX 9.05 (Series 700 computers). I think this program is valuable enough that its latest manifestation should be mentioned.

trace shows you what system calls your program is making, including as much symbolic information as possible. You can use it for figuring out why an application keeps bombing out. I have previously used this program to find out what file a program was trying to reference when it bombed out.

This version of *trace* now runs on HP-UX 10.01 and 10.20 (sadly not on HP-UX 10.10). This program can be found at *ftp.interworks.org (/pub/hp.comp/)* and at *coombs.anu.edu.au (/pub/hpux/Sysadmin/trace-1.6)*.

COMP.UNIX.ADMIN

Dotfile Generator (v 2.0)

Jesper Pedersen (*blackie@imada.ou.dk*) has created the interesting program, The Dotfile Generator, a tool to help the end user configure basic program parameters of many of the more popular programs available without knowing the syntax of the configuration files, or reading hundreds of pages in a manual. This program creates the "dot files" that are so commonly used by programs such as emacs and elm.

The Dotfile Generator includes "modules" that add application intelligence for the specific program. A module exists for the X-Windows manager, *fvwm2*. In addition, there are modules for the UNIX

shells bash and tcsh and the editor, emacs.

The program requires the Tcl/Tk packages. The Dotfile Generator is available at [ftp.imada.ou.dk](ftp://imada.ou.dk) in directory `/pub/dotfile` as `dot-2.0.tar.gz`.

COMP.INTERNET.NET HAPPENINGS

Big Brother v 1.03a

Even if you decide you don't need or want this program, Big Brother is an application that is worth looking at. Developed by Sean MacGuire (sean@iti.qc.ca), this is a free Web-based UNIX network monitoring tool. As MacGuire says, "It watches disk space, CPU loads, important processes, Web servers, and connectivity and can page you if something really horrible happens."

It is a nice example of where you can go with network and host-based management with simple Web-based tools. Remember, my company sells distributed performance management tools so we believe we really understand this marketplace and the kind of tools that are out there. The strong point of this product is the infrastructure. The weak point is the actual data that is returned. Big Brother can be checked out at

<http://www.iti.qc.ca/iti/users/sean/bb-dnld>

WEB PAGES

<http://hjh.simplenet.com/freew1.htm>

While I don't want to call myself a Windows 95 user, I must admit that I have a Windows 95 system both at my office and at home. On occasion I

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find that having the right utility or tool for this system can be an advantage. This Web site includes freeware to download, utilities, screensavers, and links to other free Windows 95 Web services.

<http://www.webplaces.com/search/>

This is a really neat idea. Have you ever needed that certain icon for your Web page and didn't know how or where to find it? This Web site includes a specialized search engine with customized search forms designed specifically to locate clip-art, icons, backgrounds, bullets, lines, buttons, and sounds.

<http://sunsite.unc.edu/JavaZine/>

<http://www.javology.com/javology>

For those of us learning and working with the new Java language, hav-

ing more resources available can only be a good thing. These two sites contain Java-oriented online magazines with news items as well as contributed utilities. ■

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BOOT

I HAVE A FRIEND FROM decades ago, who has quite an artistic flair. While we were working on a hardware design one day, and he was waiting on a schematic change from me, he drew some cartoons of typical phrases we use every day. The one that got me the most was a picture of someone's leg completing a kick and a computer flying through the air. The phrase below the picture was "I booted the computer for you." I suppose that picture appealed to me not just because it was funny, but because it was how I felt at that moment.

The computer boot process has become more complex over the years, and it can be frustrating to diagnose when it doesn't work correctly. Part of what's made the boot process of Microsoft Windows NT complex is NT's ability to adapt to a wide selection of hardware configurations. And some of the frustration in diagnosing boot trouble is a lack of understanding of what the boot process is doing at each step. So, let's dissect the boot process. I'll assume that we're talking about an Intel-based NT system only. RISC-based NT is a little different.

The boot process is composed of multiple steps. Even the hardware itself goes through multiple steps preparing for the NT boot. When the power switch is flipped on, most computers load a diagnostic program, referred to as the Power On Self Test (POST), from ROM into RAM and execute it. Visibly, the POST can be seen counting the memory address as it checks memory. The boot device is then located by searching down the list of active boot devices, such as the floppy, CD-ROM, and hard disk. You can hear this process since each device is momentarily activated. The first one found with media avail-

able is selected as the boot device.

A master boot record is read from cylinder zero, sector zero (0, 0) of the boot device and execution is begun at the first location in this boot record. This first boot program doesn't know about file systems. Its purpose is to examine the disk partition table, find the active boot partition, go to that partition, and load the partition boot sector. That's right, the master boot only finds the actual boot record, which is conveniently located at the first sector of the active disk partition.

It is the partition boot record that recognizes which file system we're running (NTFS for example), loads the NT loader (NTLDR), and runs it. NTLDR switches the computer to the 32-bit memory model, starts a mini-file system, and reads a file named *BOOT.INI*. I'll discuss the *BOOT.INI* file in a bit, but for now just note that the *BOOT.INI* file is a text file that lists boot options. As the user, we see the boot options listed on the screen, one of them highlighted, and a timer counting down until the highlighted option is booted.

The NT boot is capable of booting multiple operating systems, such as MS-DOS, Windows 95, or OS/2. If Windows 95 were loaded onto the machine, and NT then installed in a multiple boot configuration, the Windows 95 partition boot record would be copied into a file named *BOOTSECT.DOS*. If I were to select Windows 95 to boot, NTLDR would transfer control to the *BOOTSECT.DOS* program.

Back to NT. When an NT option is selected, NTLDR loads and runs *NTDETECT.COM*. As you can guess, this program is used to scan all hardware devices in your machine and to build a device list that will be copied into the

NT Registry under the hardware key in the *HKEY_LOCAL_MACHINE* hive. You can tell when *NTDETECT* is running since the screen will show

NTDETECT V4.00 checking hardware.

When it is finished, it returns the device list to *NTLDR*.

After the hardware scan, *NTLDR* loads and runs the NT kernel, *NTOSKRNL.EXE*. This is the start of the actual NT operating system. The first thing *NTOSKRNL* does is to load the Hardware Abstraction Layer (HAL). The HAL is where much of the hardware isolation is contained, making the rest of the NT modules more portable. For example, *HAL.DLL* is different for multiple CPU processors. After the HAL is loaded, *NTOSKRNL* loads the Registry entries. The entries come from both the device list generated by *NTDETECT*, and from NT registry configuration backup files.

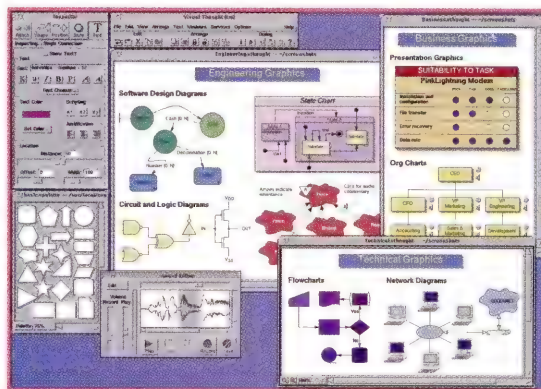
Next *NTOSKRNL* loads the device drivers. This step can be noted by the single line of dots that are displayed one by one on the screen. After the drivers are loaded, the session manager (*SMSS.EXE*) is started. At this stage, the blue screen of birth (not to be confused with the Blue Screen of Death) appears with a top line reading

Microsoft © Windows NT Version 4.0 (Build 1381)

One of the first programs *SMSS* executes is *AUTOCHK.EXE*, which scans the disk partitions and validates the file systems, much as *CHKDSK* does. *SMSS* then sets up the paging file, *pagefile.sys*, for swapping. Then the subsystems are started; most notably this includes Win32, the default NT subsystem.

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When the Win32 subsystem starts, it starts the windows logon program, *WINLOGON.EXE*. The windows logon program, in turn, starts the local security authority, *LSASS.EXE*. It is *LSASS* that displays the Ctrl-Alt-Delete logon dialog box.

The service controller, *SCREG.EXE*, is then started by *SMSS*. The *SCREG* starts each of the services designated for automatic startup, and in the order defined in the Registry. At this point the boot process is complete. After the first user logs on successfully, the current configuration is copied to the *LastKnownGood* Registry entry for possible use on the next boot-up.

Suppose we want to create a backup floppy diskette that can be used to boot our NT system should the boot records ever get corrupted. Using an NT system to format a floppy diskette and copying a few files onto the diskette can do this fairly simply. The files you will need to

copy are *NTLDR*, *BOOT.INI*, *NTDETECT.COM*, and *NTOSKRNL.EXE*. If you are booting a SCSI disk, you'll also need the SCSI device driver *NTBOOTDD.SYS*. Each of these files can be found in the root boot directory of any Intel-based NT system, except for *NTOSKRNL.EXE* which is in the *\winnt\system32* directory. The hidden attributes are turned on for these files, but unchecking the "Hide MS-DOS file extensions for registered file types" box under the Explorer's View, Options selections, will make the files visible. Except for the *BOOT.INI* file, these files are the same for every Intel-based installation.

It is the *BOOT.INI* file that defines the operating system boot options available. *BOOT.INI* is a text file that may be edited. (Note that you'll need to turn off the read-only attributes that are set on the file to be able to edit it with notepad or some other text editor. Or right-click on the My Computer icon,

select properties, and go to the Startup/Shutdown tab.) The file defines each operating system boot location, the default selection, and the timeout value. If the user doesn't respond in the timeout value, the default system is booted. Here is what a typical `BOOT.INI` file looks like:

```
[boot loader]
timeout=30
default=multi(0)disk(0)rdisk(0)partition(1)\WINNT
[operating systems]
multi(0)disk(0)rdisk(0)partition(1)\WINNT="Windows NT V4.0"
multi(0)disk(0)rdisk(0)partition(1)\WINNT="Windows NT V4.0 [VGA]" /basevideo
C:\="MS-DOS"
```

What this says is that the user is allowed 30 seconds to select the operating system, after which NT will be automatically booted. The three lines under the operating systems heading are selections presented to the user.

The last line is the selection for booting MS-DOS. Recall that booting MS-DOS transfers the boot to `BOOTSECT.DOS`.

The first two lines under the operating systems heading are defined in a device naming syntax that specifies where to find the boot record. The lines listed above are for a non-SCSI disk device. The portion `multi(0)` means use the first hardware adapter. The `disk(0)` portion will always be 0 for non-SCSI. The `rdisk(0)` portion selects the first disk on the adapter, drive 0. The `partition(1)` portion selects the first disk partition as the one to be booted. Note that the partition numbering starts from one (1), whereas the other portions start from zero (0). The `\WINNT` portion defines the root directory path of the operating system. The portion in quotes is the title displayed to the user for selection by NTLDR.

If we were booting from a SCSI device, the `BOOT.INI` file line might appear as

```
scsi(0)disk(0)rdisk(0)partition(1)\WINNT="Windows NT Server Version 4.0"
```

where the `rdisk(0)` defines the SCSI device logical unit number.

You can also put switches at the end of the operating systems lines. For example, note the `/basevideo` switch at the end of the second line under operating systems. This switch causes NT to start up using a standard VGA controller in 640x480 resolution. This is useful when you accidentally configure the system to a resolution that your graphics card doesn't support.

Simply reboot the system selecting the second entry. The system will come up in a mode in which we can properly see the display, and we can then reload the correct display settings.

Another useful switch is the `/sos` switch. This switch causes the drivers loading phase to list each of the drivers as they are being loaded.

I'm sure everyone takes the advice of the installation process and creates an Emergency Repair Disk, but most of you probably don't create a boot disk for emergencies. The need for a boot disk becomes critical if you're using mirrored drives and your primary should ever fail. It is next to impossible to boot the system from the shadow system disk without a properly created boot floppy. The shadow disk entry in the `BOOT.INI` file on the diskette might look something like

```
multi(0)disk(0)rdisk(1)partition(1)\WINNT="Windows NT 4.0 Shadow"
```

I usually set this as my default entry as well. That way I can insert the disk and just boot the system without any additional intervention if I have a crash of the primary. ■

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by Larry Headlund

Near the Beginning

MUCH OF WHAT we now call the Graphical User Interface (GUI) traces its origin through the Apple Lisa. The Apple Macintosh user interface today is a direct descendant. The popular perception of what a GUI is and how it works, particularly the Windows Icon Mouse Pointer (WIMP) paradigm, was derived from the Lisa and the Mac. Note that I said *popular* perception and *through*, not *from*. There was extensive litigation and debate about who invented what and with what inspiration and ownership rights. Certainly X, through Project Athena, begun in 1983, had a separate genesis and a different design philosophy. However, as GUIs evolved through the last decade and a half, the Apple interface and its users have been a pervasive influence.

Recently *interactions*, a publication of the Association for Computing Machinery dedicated to human computer interaction issues, published some articles about the design history of the Lisa. The authors of the main article were members of the design team for the Lisa interface. Given the influence of the final result and the consequences of the design decisions made, it seems worthwhile to return to those thrilling days of yesteryear and examine the roads taken and why.

When Did It All Start?

The Lisa project was first proposed in late 1978 and begun more formally in the spring of 1979. The goal was a machine to propel Apple into the general business market. Consider the state of business computers in 1978. The overwhelming majority of business computing was done on mainframes, with inroads from the minicomputer market. The basic operating system interface was a prompt. The wedge for

business functions on PCs was through the spreadsheet. In particular, Visicalc on the Apple II was putting the PC on business desktops. However, dedicated word processors from Wang, Lanier, etc. were dominant on that desktop. UNIX was not, indeed could not be, sold commercially. It was in use outside of AT&T, mostly in universities but also at the odd non-academic site, for example the blood bank in Pittsburgh. No one expected a new employee off the street to be able to use their computer system.

All this is not to say that no one had thought of any other possible computer interfaces. On the contrary, since at least the early 1970s there had been proposals and experiments with more adventurous modes. However, in the late 1970s there had been no commercial implementations of alternatives to the prompt and text-based programs. There had been few commercial uses of graphic screens outside of Computer Aided Design or other applications where graphics were essential. The idea of different interfaces had been proposed in the previous decade, by Englebart among others, and the Lisa designers were aware of this work, but there were no machines implementing these ideas widely available. This would change during the roughly five years of development of the Lisa, with the release of the Xerox Star, but the design team of the Lisa had essentially a blank slate, with no expectations from their target market and no installed base.

Goals

The design goal for the Lisa was a computer for general business use by secretaries, managers, and professionals that could be used without disrupting the office. It was to be fun to use and to

References:

- "Inventing the Lisa User Interface,"
Roderick Perkins, Frank Ludolph,
and Dan Smith Keller, *interactions*,
January-February 1997, Volume
IVI
- "What you see is ALL you get,"
Harvey Lehtman, *interactions*,
January-February 1997, Volume
IVI

require minimal user training and "hand holding." The fun-to-use part was most subjective, but the requirement for minimal user training and hand holding had some immediate design consequences.

Minimal user training mandated a standard user interface. A consistent set of commands for every application meant that the knowledge of one set of commands could be transferred to all applications. This imperative can be enforced when there is a single source, a single organization obedient to the directive producing all the applications, but how can independently produced applications be made to conform? The *interactions* article is concerned with the design process inside Apple and does not consider this issue. As it turned out, what became the Macintosh was famous for the consistency of its applications' interfaces. How did this happen? It was a result primarily of limitations in the memory and processing power of the original Macintosh! It was only practical to produce applications for the Macintosh using the supplied components. Ignoring the style guide and creating applications from whole cloth, as was standard practice on other architectures, was prohibitively expensive in terms of computer resources, hence the path of least resistance was a consistent interface.

Pros and Cons

The decision for a consistent user interface was a decision, with viable alternative philosophies and arguments pro and con. The X Window System explicitly did not have a policy on user interfaces. The layers above X, for example Motif and the CDE, determine user interfaces. Individual X applications have successfully mimicked Macintosh, MS Windows, and MS DOS applications.

Continued on Page 70

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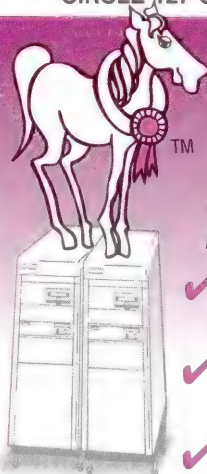


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The arguments for a consistent user interface seem obvious—how can they be argued against? Consider that a mode of operation consistent across all applications is probably optimal for none. An analog to this argument is the issue of specialized computer application languages versus general-purpose languages. Is it better to have efficient (by whatever measure) distinct languages for text processing, process control, numerical computation, graphic manipulation, and so on, or is it better to have a single language to learn, one that does all of the above but with handicaps in any particular field? PostScript and SQL argue on one side, Perl and the Korn Shell on the other. I have also had clients in specific fields, particularly heads-down order entry, argue against the use of standard interfaces when the price of those interfaces includes a decrease in operator speed (more key strokes) or an increase in computing resources. User friendliness isn't the only factor in human factors.

A non-computer analog of the above question is found in the humble Swiss Army knife. I have one in my pocket now and never travel without it. It is convenient to have all those tools together, compactly sharing a common handle. However, individually the tools are a little awkward. They are not the best adapted knife, screwdriver, file, or scissors to my hand. The best tools for all jobs may not be the best tool for any job.

When the exact nature of the user interface is decided at the operating system and hardware design level, the decisions had better be correct because there may be no easy fixes. A familiar example of a bedeviling legacy is the decision to have essentially no security built into the operating system with MS-

DOS. The machinations and convolutions bedeviling Java applets in an attempt to layer needed security for distributed applets are partially a consequence of that original design decision.

Note also that ease of programming applications was not a design criterion. The end-user was the exclusive focus, not what would be easier for the developer. Contrast this with the Lisp machines and the Smalltalk environments, which were contemporary with the birth of the Lisa. These were developer's environments first. The Lisa/Macintosh turned out to be a relatively developer friendly environment, but that appears to be serendipitous. Contrast also the NextStep environment, in which making life easy for the developer was an early consideration, or MS Windows, on which few program directly, relying on foundation classes, programming environments, frameworks, etc., to shield the developer from the API proper. While there are tools like this for the X world, they are not the necessity here that they are in MS Windows.

A Fable

Since I mentioned NextStep, some heavy irony intrudes. NextStep came from Next Computer, the company Steve Jobs founded after leaving Apple. It is based on the Mach kernel from Carnegie-Mellon University in Pittsburgh and the whole environment on Next would not have been possible without utilities from Richard Stallman's Gnu Not Unix (GNU) project. Most dramatically from a development standpoint, the NextStep Objective-C compiler was based on *gcc* from the Free Software Foundation and the enhancements the Next team added were

released under the GNU General Public License (GPL). The *gcc* compiler is one of the two most popular FSF products (the other is the editor *emacs*) and both of these are strongly Richard Stallman's handiwork. Since the GPL has never, to my knowledge, been tested in court, this observance of the GPL by a major corporation when it arguably was not in the corporation's interest to do so is the strongest argument for the ultimate legal validity of the GPL. While this was going on, Apple sought to protect its shrinking market share against MS Windows by asserting intellectual property rights derived from the Lisa/Macintosh interface. The implications of this assertion so alarmed and incensed Stallman and the FSF that for a decade Apple products have been the one platform that was explicitly not supported for FSF products, that was boycotted. As this was going on, MS Windows came to dominate the commercial desktop. Desperate, in late 1996 Apple brought Steve Jobs back and announced that their next generation operating system would be based on the NextStep OS, the one with all the GNU history.

There is probably a moral in the above story but damned if I know what it is. ■

Larry Headlund is the president of Mathematical Engineering, Inc., a UNIX and Motif development company. He has been working with commercial UNIX since 1983 and with X since 1987. He can be reached at lmh@world.std.com or at 1 617-242-7741.

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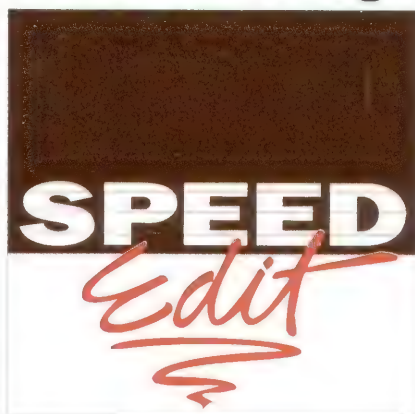
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CIRCLE 51 ON READER SERVICE CARD



CSL Perspective

ONE OF THE CHALLENGES system administrators on UNIX-based systems face is providing a rich computing environment for their end-users. Although many of us may be a bit selfish at times in wanting the system to empower us, applications and the systems they run on benefit us primarily as enablers for improving the business of our companies. It is these business goals that drive most of the buying decisions for hardware and software, as well as the way the system is deployed and how it is maintained long-term. From time to time, requirements arise that cannot be met adequately with the software initially deployed, so many a system administrator turns to the freely available domain.

Fortunately, the UNIX community has been working in this "open" fashion for some 20 years. The amount of software out there is immense, both in numbers of packages as well as in capabilities. Unfortunately, this is a double-edged sword because much of this software is distributed in a form that is neither easy to use nor easy to support. And in some cases, some background in software development is useful to get the most use out of the software. Let me illustrate with an example.

Once I have identified a need for some capability or function, I then begin to work through a process something like this:

1. Search the net for an appropriate package
2. Download the software to the local system
3. Unpackage the software into its components
4. Read and understand the installation instructions
5. Install the software (including compiling the source, linking, and

deploying the executables)

6. Test the functionality to make sure it meets the requirements
7. Deploy the package across the environment
8. Notify and possibly train the users
9. Figure out how to support the package long term

If I am a fairly new administrator, this is going to be a tough problem to solve. I may not have the requisite experience to utilize the package effectively. I may also see some risk in even attempting it, and I'm eager to solve the problem for both the end-user as well as my management. It may even drive me to spend my time looking for a commercial package to use. Sound familiar?

Many will agree that this is the current state of affairs in much of the UNIX marketplace, and it is much truer of the HP user community than of almost any other. Many of those in the Sun camp essentially grew up with UNIX and have much of the skill base to deal with the effective deployment of free software. In the HP camp, it's a slightly different situation, primarily because of the success of HP's Mainframe Alternative programs as well as their success in the commercial marketplace (somewhat driven by the success of the HP 3000). This has translated into an influx of new users who have many generic skills such as system management or programming, but may feel very intimidated by the sometimes cryptic UNIX environment. As these individuals look outside for software, they may feel helpless to take advantage of much of what is available. This has been an ongoing problem in the Interex and InterWorks libraries for several years.

InterWorks and Interex, working together, have been moving forward on a project called FAST (Freely Available

Software Technology). The primary objective of FAST is to deliver functional software that is useful to end-users and easy to install and maintain for system administrators. The initial package bundles will consist of the 100 top packages from the user community, ported to HP-UX 10.x. A decision was made not to deal immediately with previous 9.x versions since the HPPD in Liverpool already has pre-built packages for many of the same bundles. Users who cannot immediately upgrade can still utilize those packages.

A significant obstacle that had to be overcome early in the project was deciding on porting standards, distribution formats, and file system conventions for both porting and deployment. To meet these challenges, a number of the porters as well as representatives from all the groups, met electronically and put together a standards document. You can find this document at <http://www.cs.berkeley.edu/~staelin/software.html>. As you review the standards, you can get a sense of how some of these standards help us realize the primary goals: ease-of-use and supportability. Some might argue over the details, but we believe that we're most of the way there.

With any luck, by the time you read this, the first release of these bundles will be available through both Interex and InterWorks. We're very hopeful that this activity will enhance the value of your investment in HP hardware and software, making it easier to use and support. ■

Paul Gerwitz is chairman of the CSL/HP-UX committee and technical consultant at Hewlett-Packard. Previously, he served as a technology specialist at Eastman Kodak Company in Rochester New York. He can be reached at 716-477-3067 or e-mail at gerwitz@interex.org or pgerwitz@delphi.com.

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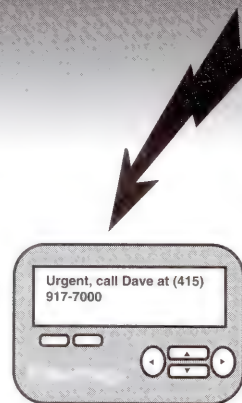


CIRCLE 52 ON READER SERVICE CARD

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CIRCLE 91 ON READER SERVICE CARD



HP 1000 Guru

Q: We keep hearing about all the “year 2000” problems that, according to certain “experts,” are going to cause major chaos. How does the HP 1000 handle the upcoming new millennium? What problems, if any, can we expect to encounter?

A: First of all, the HP 1000 has no inherent problem with the year 2000. Over the years, several time-related problems have been corrected as they were encountered. What we will try to do here is describe what these problems were, what they affected, and when they were fixed. This is in no way a comprehensive list, and certainly there could be unknown problems with different subsystems. The focus of this column will be RTE-A, since RTE-6 has no official support beyond 1999. When possible, we will make comparisons to RTE-6.

First some background on how time is managed in RTE-A.

All A Series CPUs have a Time Base Generator that ‘ticks’ every 10 milliseconds. These ‘ticks’ are accumulated in system entry point \$TIME (and \$TIME+1) as a double-integer. This value is then interpreted as the negative number of centiseconds until midnight.

Entry point \$TIME+2 is a second accumulator that counts the number of days since January 1, 1976. (In RTE-6, this is January 1, 1970) This value is then converted into the appropriate Day-month-year when needed. This theoretically means the maximum year in RTE-A is 2065, or 2155 if we treat \$TIME+2 as an unsigned integer.

File system timestamps are stored as double-integer values in the file’s directory entry. This double-integer number is

the number of seconds since 1970. This is the same in both RTE-A and RTE-6, for compatibility. So the maximum year for a file’s timestamp is $2,147,483,647 \text{ seconds} / (60 * 60 * 24 * 365) = \text{approximately } 2037$.

File Manager and type 0 files, (which have no actual timestamps) will appear with a timestamp of January 1, 1970 when viewed by a program such as FST that stores timestamp.

As you can see, the maximum year for RTE is different from the file system’s, because of the way the information is stored. And it should be apparent that this scheme has no inherent problem when the year 2000 rolls around. The problems that have existed were caused by the interpretation of these numbers. And this inconsistency led to one of the problems we’ll see later.

Another date that appears in RTE-A is April 1, 1983. This is the release date of the original RTE-A (Previous versions of RTE-A were known as A.1) RTE-A introduced the hierarchical file system, CI, and Code and Data Separation (CDS, which was actually sold as a product separate from RTE-A called VCPLUS). When an RTE-A system is booted, the default startup time is April 1, 1983.

This date is placed in \$TIME+2 by the RTE-A Generator program. Thus if one forgets to set the time on bootup, the clock starts at 12:00:00 AM on April 1, 1983.

(For RTE-6 this date is December 1, 1981. But sometime in the 1980s, this startup date was changed to be the current system time when the RTE-6 generator was run.)

So, what problems have been encountered? Actually, they are very few in number. We will list these in order of apparent severity (our choice!).

SIGs

If your area of expertise involves HP systems, there is a place you can go to get the kind of specialized, top level information that's valuable to you. Interex Special Interest Groups (SIGs).

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CIRCLE 156 ON READER SERVICE CARD

1. The library routine FTIME, which is called to return the formatted ASCII time, was broken for the year 2000 and above. It was originally coded using 1900 as a hardcoded base. This caused FTIME to return the year as 19:0 for the year 2000, 19:1 for 2001, and so on.

This was fixed in Release 5.0. If you are using a release prior to 5.0, the easiest workaround is simply to relink any programs that call FTIME, and relocate a later version of FTIME from \$BIGLB. This can be done in link as follows:

link: RM,/Newer_libraries/\$BIGLB.LIB,FTIME

This will relocate just the module FTIME. The version of \$BIGLB can be anything up to 6.2.

2. Prior to Release 6.2 of RTE-A, the time setting routine found in &TIME allowed the system time to be set to years up to 2144. Obviously, this was inconsistent with the file system max year. So as of 6.2, the TM command will allow years only from 1976 till 2037. Not normally a problem, since one wouldn't usually set the system time incorrectly. But if it is set incorrectly, it will cause FMP problems.
3. Years beyond 2037 are not valid for FMP timestamps. If

the system time is set to a year beyond 2037, and a file is updated or created, certain masking functions will fail. Typical symptom: a DL will not find the file, yet EDIT or LI will display the file.

The solution is (1) Don't set the time incorrectly and (2) if you do, then reset the time correctly and copy the file to update the timestamp.

While on the subject of masking: We have tested timestamps in masks and as of 6.2 have not discovered any problems using dates in the year 2000+ range. This is not to say that earlier releases did not have a problem; we just are not aware of any.

5. There is a routine called DAYS70, contained in module &DLIB2, that failed for years 2000+. This routine is used only by MACRO, and thus should not be a major concern.

This was fixed at Revision 6.2.

6. Two PASCAL routines, PAS.TIMESTAMP and PAS.TIMESTRING, do not handle the year 2000 correctly. This affects WH and LANVCP.

This was fixed at Revision 6.2.

7. EDIT/1000's internal timestamp is also afflicted by a similar problem as FTIME above. It will display "0" as the year for the year 2000 and so on.

This problem was fixed in EDIT itself at 6.2.

- 7a. EDIT/1000's internal timestamp feature displays only 2 digits for the year. Thus starting in the year 2000, the timestamp will be <000101.000>.

This will not be changed, due to possible adverse impact on existing code.

8. Now we're down to the really minor problems. The 6.0 *Programmer's Reference Manual* states that SETTM has an upper limit of 1999. This is incorrect, as the limit was really 2144. Of course that limit was subsequently made 2037 (at 6.2) to match FMP timestamps.

Documentation was updated at Revision 6.1.

And now a word about leap year. Everyone knows that leap year occurs every four years, when the year is divisible evenly by 4. Thus the year 2000 is a leap year by this simple rule. But there is a secondary leap year rule that if the year is divisible by 4 *and* by 100, then it is *not* a leap year. Thus 1900 was not a leap year and it follows that 2000 should not be a leap year. Many people are not aware of the Divide-by-100 rule. And even fewer are aware of the Divide-by-400 Rule: If the year is divisible by 400, then it *is* a leap year. This overrules the Divide-by-100 rule. Confused? Let's do it in FORTRAN:

```
if (mod(year,4).eq.0) then
  if (mod(year,100).ne.0.or.mod(year,400).eq.0) then
    LeapYear = .TRUE.
  endif
endif
```

Other subsystems that have been tested to some degree include:

FORTTRAN—FORTTRAN does not have intrinsic time/date routines. However, the date printed on the listings will roll to 1900 after the year 2037.

BASIC—Routines TIMEDAY and TIMESTRING have been tested in the year 2010. They worked fine.

C—not tested yet.

Image-II—Only has two date functions, DATE and EDATE, which both use a four-digit year and have been tested to December 31, 2037.

It is our feeling that one of the largest impacts of the year 2000 may involve custom or third-party application code that

uses only two digits for the year. Obviously, when the year 2000 occurs the "number" will roll from 99 to 00 and all sorting using this number will fail when mixed with numbers before the year 2000.

Q: Is any HP 1000 information available on the Web?

A: As a matter of fact, yes. From the Hewlett-Packard Web Site, located at:

<http://www.hp.com/>

You will find HP 1000 information located at:

<http://www.hp.com/computing/rte/>

Also, we have implemented an e-mail Autoreply node, which contains various technical articles, including archives of past HP 1000 Guru columns. The address is:

Rte_Support@hpwrcxe.mayfield.hp.com

Just send a message with the word INDEX in the Subject. You will be sent an Autoreply with a list of articles available. Just follow the instructions. ■

Walt Boeninger works in the HP Response Center in Mountain View, California. He has been supporting the HP 1000 for 15 years. His e-mail address is: walt@hpwrcxe.mayfield.hp.com

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RGB SuperView 1000**Multi-Video Windowing System**

RGB Spectrum has announced SuperView 1000, which displays multiple video images on a single screen. Video input signals may be NTSC, PAL, or S-Video, and the display screen may be any monitor or data display projector up to 1,600 x 1,280 pixel resolution.

Standard SuperView 1000 models come configured for 4- or 6-video display, but can be upgraded to handle up to 24 live video windows simultaneously, providing a reliable, low-cost alternative to video walls and other arrays of monitors or projectors.

The product's features include pan and zoom, the ability to independently position and scale windows, and automatic genlock to a computer signal for overlaying graphics.

Contact RGB, phone: (510) 814-7000, fax: (510) 814-7026, <http://www.rgb.com>.



to the Microsoft Windows NT Server running EDI translations through spEDI*tran. The new EDI capability will allow DRA's 800 customers to automate the process of ordering and procurement for a seamless integration with their suppliers.

Contact St. Paul Software, phone: (612) 603-4400, <http://www.stpaulsoftware.com>.

New From Black & White Software**Java Objects Across Internet**

Black & White Software has announced Web/Enable, which employs object technology for Web application development. Web/Enable encompasses Java and CORBA IIOP to provide an infrastructure for building or migrating applications that function across the Internet and intranet. With Web/Enable, servers can be created and registered with the CORBA Object Request Broker (ORB) and then be accessed from within Web/Enable to easily create client applications or applets in Java or C++.

The Web/Enable solution includes a graphical palette of Java components and tools for constructing clients and servers, automatically integrates GUI and three-tiered distribution based code, offers IDL development and CORBA 2.0 conformant features, and facilitates the administration of deployed application across a network. Web/Enable contains OrbixWeb and also builds on UIM/X.

Web/Enable is priced at \$3,500.

User Interface Management

Black & White Software has announced UIM/X 3.0, a new version of the user interface management system for CDE/Motif. New features include

Continued From Page 16

Usenet Indexing Engine

Hummingbird Communications Ltd. has announced NewsWatch, a Windows NT-based server that automatically indexes Usenet feeds, allowing users to perform simple and complex queries through any Web browser. Designed to filter out user-specified information from thousands of Usenet articles posted daily, Hummingbird NewsWatch delivers user's queries of the indexed database in customizable HTML pages or scheduled e-mail messages.

The product automatically informs users when a topic of interest appears and enables them to go directly to the articles they need.

NewsWatch requires Windows NT 3.51 or later and 16 MB of RAM. It is priced at \$995.

Contact Hummingbird Communications, phone: (415) 917-7300, fax: (415) 917-7310, <http://www.hummingbird.com>.

CD-ROM and Web Server

Todd Enterprises has announced

OPTI-NET Direct HL-7, a complete CD-ROM and Web server. The 4.76 GB tower/server system (including OptiView Management software) is installed in a fully equipped seven-drive tower. It attaches directly to an Ethernet network without any additional software or file server.

OPTI-NET Direct provides shared CD-ROM access over the user's Ethernet network. The product serves up CD-ROMs as mountable volumes to NetWare and NFS clients, and as Web pages to Internet/intranet clients. A built-in WWW server enables users to access the CDs using any Web browser.

Contact Todd Enterprises, phone: (800) 445-8633 or (516) 777-8633, fax: (516) 777-2750, <http://www.toddent.com>.

Electronic Commerce Solution

St. Paul Software has announced the integration of their spEDI*tran product with DRA Classic, the Library Management System (LMS) from Data Research Associates (DRA). DRA's LMS runs in Windows NT, UNIX, and Open VMS environments, and is networked

an embedded C++ interpreter, expanded support for true object-oriented development, and numerous usability enhancements.

UIM/X is an interactive object-oriented tool, supporting encapsulation and polymorphism, as well as the specification and implementation of class hierarchies. Developers can create, modify, and test the layout and behavior of user interfaces with the underlying application connected and running, without having to compile code. In addition to the C++ interpreter, UIM/X 3.0 includes support for both graphical and non-graphical objects, a Connection Editor for visually creating callbacks, a complete C++ convenience library, a Constraint Editor for graphically defining constraints on GUI elements, enhancements to Novice Mode, user interface improvements, and a Bubble Help system.

Pricing for the UIM/X 3.0 is \$5,000.

Contact Black & White Software, phone: (408) 369-7400, fax: (408) 369-7406, e-mail: info@blackwhite.com, <http://www.blackwhite.com>.

Web-based Electronic Commerce

ParcPlace-Digitalk, Inc. have announced HP certification of VisualWave 2.0 for use with HP's VirtualVault software. Together, the products will allow companies to rapidly deploy secure electronic-commerce solutions across the Web.

As a complete object-oriented development environment for both client-server intranets and the Web, VisualWave allows corporations either to reuse existing client-server applications or develop new ones and then deploy those applications directly on the Web. HP's VirtualVault software ensures end-to-end integrity of all inter-

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CIRCLE 180 ON READER SERVICE CARD

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SecurityAudit/UX RUNS ON ALL HP-UX BASED 9000 SERIES 700 AND 800 SYSTEMS, AND HAS BEEN SPECIFICALLY TAILORED TO ADDRESS PECULIARITIES OF HP-UX, SUCH AS PDF, ACL AND HP'S SHADOW PASSWORDS.

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CIRCLE 40 ON READER SERVICE CARD

Graphical Spreadsheet

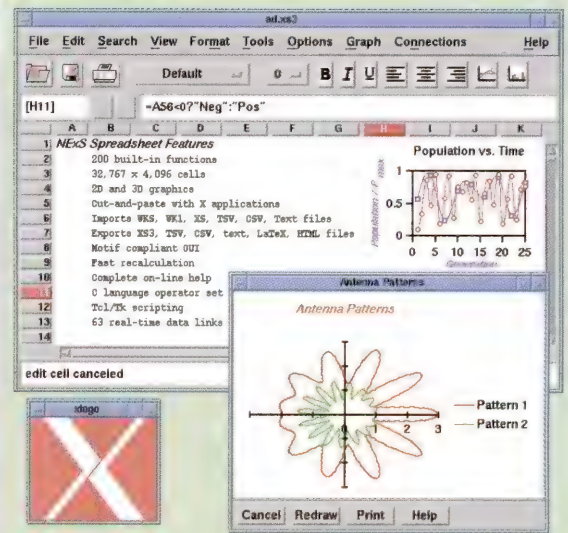
X Engineering Software Systems (XESS) has announced the NExS 1.3 spreadsheet for Linux and UNIX workstations.

NExS—the Network Extensible Spreadsheet—is a full-featured, graphical spreadsheet developed specifically for UNIX and the X Window System. It has more than 237 built-in business and scientific functions, allows user-customized functions, displays data using 2- and 3-dimensional graphs, and imports and exports data in a wide variety of formats (including HTML tables).

In addition, the conNExions API gives external processes complete control of NExS spreadsheets. For example, the API lets a remote data acquisition program transfer data over the Internet to the NExS spreadsheet for real-time updates. NExS can also control the data-feed by communicating back to the remote process through the API. The conNExions API supports up to 63 of these simultaneous, two-way connections.

Pricing starts at \$149. Demonstration copies may be downloaded from <http://www.xess.com>.

Contact XESS, phone: (800) 961-7840 or (919) 387-0076, fax: (919) 387-1302.



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Contact ParcPlace-Digitalk, phone: (800) 759-7272 or (408) 481-9090, fax: (408) 481-9095, <http://www.parcplace.com>. Contact Hewlett-Packard at <http://www.hp.com/go/internet>.

Finite Element Analysis

Structural Research & Analysis Corporation has announced COSMOS/FFE for MSC/NASTRAN and COSMOS/FFE for ANSYS, which allows users of the two legacy finite element analysis programs to model and post-process their problems in the usual manner with NASTRAN or ANSYS but to solve them much faster with COSMOS/FFE.

SRAC's proprietary FFE is a new analysis technology that provides answers to complex problems up to 100 times faster than conventional FEA programs, while reducing disk storage requirements by more than 20 times. Equipped with built-in expert system features, FFE automatically chooses the most efficient way to solve problems and

use existing resources. FFE also evaluates available computer resources and will prompt users before they start if they don't have enough disk space to run the model. FFE can even warn users if a model has not been set up properly.

COSMOS/FFE for NASTRAN and COSMOS/FFE for ANSYS are available for UNIX platforms only, for \$10,000 each.

Contact SRAC, phone: (310) 207-2800, <http://www.cosmosm.com>.

Standardized Persistent Collections

Object Design, Inc. and ObjectSpace, Inc. have announced two new Object Managers for use with Object Design ObjectStore database and ObjectStore PSE products. Object Design and ObjectSpace integrated the JGL and STL libraries with ObjectStore in order to provide users with full collection support for persistent Java and C++ objects. Developers can build ObjectStore-based applications with cost-effective, reusable persistent object collections.

The new Object Managers result from the integration of ObjectSpace's

Java Generic Library (JGL) and ANSI/ISO C++ Standard Template Library (STL) with ObjectStore.

The ObjectSpace JGL Object Manager is available for free download from the Object Design Web site at <http://www.odi.com>.

The ObjectSpace STL Object Manager is available free to ObjectSpace C++ Library customers as part of an annual support service.

Contact Object Design, phone: (617) 674-5162, or ObjectSpace, phone: (214) 823-8242.

Performance and Capacity Management

BGS Systems, Inc. has announced BEST/1 Performance Assurance for SAP R/3, an integrated performance and capacity management tool, with initial availability for UNIX environments. It is designed to allow IT professionals to manage performance and capacity for SAP R/3 application modules, such as Sales & Distribution, Human Resources, Production Planning, or Materials Management.

BEST/1 for SAP R/3 analyzes UNIX and SAP R/3 CCMS data and provides unique automating capabilities, including application and database server performance management; state-of-the-system SAP resource usage yesterday, today, and tomorrow; and SAP R/3 capacity planning with "what-if" performance modeling.

BEST/1 Performance Assurance for SAP R/3 can analyze, track, and manage the data by multiple differing views of the total SAP R/3 workload.

Pricing starts at less than \$50,000.

Contact BGS Systems, phone: (617) 891-0000, fax: (617) 890-0000, e-mail: best1@bgs.com.

Customer Service Application

Hewlett-Packard and Information Management Associates (IMA) have announced the integration of HP's Customer Contact Manager middleware with IMA's EDGE TeleBusiness Software System.

Users can now build industry-tailored EDGE customer-service applications and execute standard computer-telephony-integration functions from within these applications, such as dial, call-transfer, and call-conference. Customer Contact Manager will carry out these actions by bridging the applications to a broad range of automatic call distributors, telephone switches, and voice response units.

The EDGE TeleBusiness Software System enables organizations to develop customized customer-interaction applications to support telesales, telemarketing, and customer-service operations.

Customer Contact Manager manages and integrates customer communications with customer-service applications and databases, addressing computer telephony integration, as well as support for Internet, fax, and e-mail communications.

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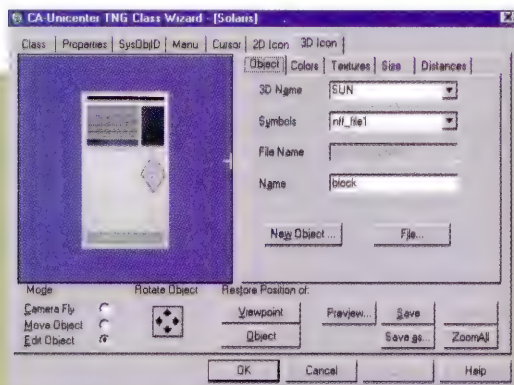
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CIRCLE 76 ON READER SERVICE CARD

**Computer Associates Unicenter TNG**

Enterprise Management

Computer Associates International, Inc. (CA) has announced Unicenter TNG (The Next Generation), an enterprise management platform which manages, monitors, and controls

global IT resources—from the desktop to the mainframe, from LANs to the Internet—with a business process perspective.

Unicenter TNG reaches out to every IT resource—including networks, systems, applications, and databases—regardless of type or location.

Unicenter TNG combines fully integrated solutions built upon a comprehensive object-oriented framework. Users can manage Internet and intranet resources, Intel-based servers and desktops, and even noncomputing devices such as environmental controls. Its open and scaleable architecture eliminates any inherent limit to its management scope.

Its intelligent agents and correlation engine are designed to pinpoint problems and automatically resolve them with minimal overhead.

Pricing starts at \$2,500.

Contact Computer Associates, phone: (516) 342-5224, fax: (516) 342-5329, e-mail: info@cai.com, <http://www.cai.com>.

dant server systems with their costly overhead. PowerSwitch/NT installs using Microsoft Windows NT Server or Workstation and supports any combination of servers, disk drives, duplexed or mirrored arrays, RAIDs, and peripherals.

PowerSwitch/NT supports up to 16 servers. In the event of a server failure, PowerSwitch/NT reconfigures the operating system to a secondary server in moments, ensuring full data availability. Users have nearly immediate access to a fully functional network, complete with original up-to-date data. The network servers stay up and running, even when the system administrator is off site. The secondary server can operate the network when necessary.

PowerSwitch/NT is priced at \$995 and supports 16 servers; it is available off the shelf. An evaluation copy can be downloaded at <http://www.apcon.com>.

Contact APCON, phone: (503) 639-6700, fax: (503) 639-6740.

SNMP Management for Novell NetWare

Translink Software has introduced Event Director (or EventD), a new client-server-based agent that extends any network management system that uses the industry-standard protocol SNMP, including allowing users to oversee Novell NetWare servers.

EventD is an early warning system against poor performance or diminishing resources. The agent enables users to monitor and manage their Novell NetWare network with other elements of the network in an integrated management environment, all from one console.

The self-managing system can identify potential disasters and audit network activity. All is shown at the management station as it happens, enabling users to

and e-mail support.

UNIX-based Internet Service Providers can now offer customers all the advantages that FrontPage, together with the extensions, provide—remote authoring, remote site management, and WebBot components. The latter enables nonprogrammers to create professional-quality Web sites by simply “dropping” into their Web sites dynamic features such as full-text search, threaded discussion groups, and registration forms.

Contact RTR, phone: (508) 692-9922, fax: (508) 692-9990, <http://www.rtr.com>.

Scaleable High Availability

APCON, Inc. has introduced PowerSwitch/NT, a flexible alternative to redun-

Contact IMA, phone: (203) 925-6800, fax: (203) 925-1170, <http://www.ima-inc.com>.

Server Extension Software

Ready-To-Run Software (RTR) has announced Microsoft FrontPage Server Extensions for a wide range of UNIX Web servers, enabling organizations to host Web sites created and managed with Microsoft FrontPage.

Under an agreement with Microsoft, Ready-To-Run Software will assist in providing support for the FrontPage server extensions, including porting the extensions to new platforms, making the extensions widely available via the Internet (<http://www.rtr.com/fpsupport/download.htm>) and providing phone

be proactive on security issues. Users can decide which events to monitor and when to be told about them.

Contact Translink Software, phone/fax: (+44) 1753 715872 (U.K.), <http://www.translink.com>.

Tape Management

Alida, Inc. has announced that its network-based backup, restore, and tape management software, GT Backup, has been enhanced so users can employ a command-line interface to execute all GT Backup commands throughout a network from any remote or local PC or terminal.

By employing a command line setup to establish a "cron entry," GT Backup users ensure the complete and timely execution of each and every job. From any network location, this entry will instruct GT Backup to check availability of drives and check that the correct tapes are in specified drives—eliminating the most common cause of backup and restore failures. Times and dates for these commands may also be preselected and are executed automatically throughout the network.

GT Backup runs in a client-server environment on UNIX platforms.

It is priced at \$595 for a single-user license, with multistation network discounts.

Contact Alida, phone: (800) 883-GURU or (201) 384-0080, fax: (201) 384-3382, <http://main.street.net/alida>.

Stereoscopic 3D Visualization

StereoGraphics and EDS Unigraphics have announced Unigraphics' V12 design and modeling software with built-in support for StereoGraphics CrystalEyes stereoscopic 3D eyewear. The combination of StereoGraphics



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**Belmont Research CrossGraphs****Data Visualization**

Belmont Research, Inc. has announced the Customization Option for CrossGraphs, its data visualization and graphical reporting software. CrossGraphs shows important patterns and

trends in multidimensional data by displaying many graphs, one graph per subset, on one or many pages. The Customization Option lets software professionals extend CrossGraphs with graph types, procedures, and user interfaces that are tailored to meet the particular data retrieval and analysis needs of their companies.

Customizations let people retrieve, visualize, and interact with corporate databases using natural, highly visual user interfaces, enabling them to make better decisions based on complex information.

A high level of integration is possible with the Customization Option because CrossGraphs also operates as an OLE automation server.

Pricing starts at \$1,995.

Contact Belmont Research, phone: (617) 868-6878, fax: (617) 868-2654, e-mail: cginfo@belmont.com, <http://www.belmont.com>.

CrystalEyes and Unigraphics V12 will speed up the 3D design process and provide virtual prototyping capabilities to all Unigraphics users.

CrystalEyes is a lightweight, wireless eye-wear system that delivers high-definition, stereoscopic 3D images in conjunction with compatible software and standard workstation displays. It allows professionals dealing with multi-dimensional data to visualize problems and analyze information more quickly and effectively.

CrystalEyes is priced at \$995, including infrared emitter.

Contact StereoGraphics, phone: (800) 783-2660 or (415) 459-4500, fax: (415) 459-3020, <http://www.stereographics.com>.

Network Data Collector

Onion Peel Software has announced a new Network Data Collector (NDC) for HP OpenView. NDC gives network managers a tool for intelligent data collection and reporting. Its collection sys-

tem reduces traffic and streamlines collections and generates batch jobs through the command line. Command-separated format makes it easy to create spreadsheets or graphs. NDC is based on selection rules and MIB expressions with basic reporting skills such as an SQL-like command language that allows simple text files to collect data and build reports.

Contact Onion Peel Software, phone: (919) 571-7910, fax: (919) 571-8338, e-mail: sales@ops.com, <http://www.ops.com/>.

New from Hewlett-Packard**Pre-Loading SAP R/3**

Hewlett-Packard has introduced a service for preloading, preconfiguring, and pretesting SAP/R3 solutions prior to delivery to customer sites. HP is the only SAP partner to offer this service for HP-UX, Microsoft Windows NT, or mixed HP-UX/Windows NT system environments.

The new service allows HP customers

to reduce on-site installation time and minimize disruption to core business activities since the actual preloading activities are conducted by HP technicians at a central HP facility.

As part of this service, HP delivers to the customer a preintegrated solution, including R/3 and database software, HP 9000 business servers or HP NetServer PC servers, and other solution components. The HP facility handles the complex logistics of delivering the new system to customer sites, including multiple deliveries in one country or several countries around the world.

This service also is available to customers who order through HP partners that act as the prime contractors for R/3 implementations.

HP and Oracle Joint Technology

Hewlett-Packard and Oracle Corporation are increasing joint technology development and integration efforts. The companies are working on an open, networked computing environment targeted for IA-64, Intel's future 64-bit processor that was developed jointly by HP and Intel.

The partnership is expected to produce mission-critical solutions capable of performing billions of transactions per week, per system to support global, networked enterprises.

Attention vendors: New product announcements should be sent to New Products Editor, hp-ux/usr magazine, Interex, P.O. Box 3439, Sunnyvale, California 94088-3439, USA, or e-mail: pollace@interex.org.

Deadline for submission is 2½ months prior to publication.



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The *hp-ux/resource directory* is a complete resource guide for HP-UX users seeking answers. This is one of the industry's most extensive reference guides for HP-UX products, services, and vendors. It will be devoted entirely to HP 9000 users operating in multi-user, workstation, and multi-system UNIX environments. This bi-annual directory, published each year in March and September, is a separate publication mailed out with *hp-ux/usr* magazine, the only HP-specific publication on the market.

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Application Development Software	Government & Utility Software	Process Control Software
Application Development Tools	Graphics	Production Planning
Application Development Tools/4GL	Groupware	Project Management
Application Engineering	Hardware	Programmer's Editor
Backup/Restore	Hardware/Mass Storage	Protocol Converters/Interfaces-Hardware
Backup Software	Hardware Subsystems	Publications
Bar Code Data Collection Systems	Help Desk Management	Public Safety Software
Batch Job Management	Human Resources & Personnel Systems	Quality Assurance Tools
Books	Image Processing	Records Management
Business-Critical Application Development & Deployment	Image Storage & Retrieval Management	Rentals
Business Software	Industrial Terminals	Report Viewing, Printing, & Distribution
CD-R	Input Devices	Report Writers
CAD Software/Hardware	Instrument Control	Sales & Marketing
Change Management for Software Development	Integration Tools	Scheduling
Change Management Tools	Internet	Scheduling/Task Management
CheckPoint Restart Facility	Internet Commerce	Security
Client-Server	Internet/Intranet	Service Repairs
Client-Server Software	Internet Services	Software
Communications	Internet Solutions	Software Backup
Communications Servers	Inventory Control	Software Development Tools
Communications Software	I/O Boards	Software Distribution Tools
Consulting	Job Scheduling & Workload Management	Software Maintenance & Testing
Consulting/Systems Integration	Justice Software	Spoolers
Customer Support	Laser Printing Software	Spreadsheets
Customer Support/Help Desk Systems	Maintenance	Statistics/Data Analysis
Database Management Systems	Manufacturing Software	System Integration
Database Management Tools	Mass Storage	System Management
Data Center Management	Mass Storage Peripherals	System Management Tools
Data Migration Tool	Math Library	System Printers
Data Warehousing	Memory	3-D Graphics Tool Kit
Decision Support Systems	Memory Upgrades	3-D Porting Tool
Diagramming & Flowcharting	Middleware	Tape Backup Products
Disaster Recovery	Migration Services	Tape Storage/Data Interchange
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Document Management	Multimedia	Text & Information Retrieval
Electronic Data Interchange (EDI)	Network Backup Software	Text Editors
Electronic Form Printing	Networking	Time & Billing
E-Mail & Directory Integration	Networking Systems	Time Reporting Terminals
End-User Access Tools	Network Management	Training
End-User Computing	Output Management	User Groups
Equipment	Payroll	Video/Keyboard/Mouse Extension
Executive Information Systems	PC Card Reader	Warehouse & Distribution Management
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Fax Automation	PC Integration	
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hp-ux/resource directory

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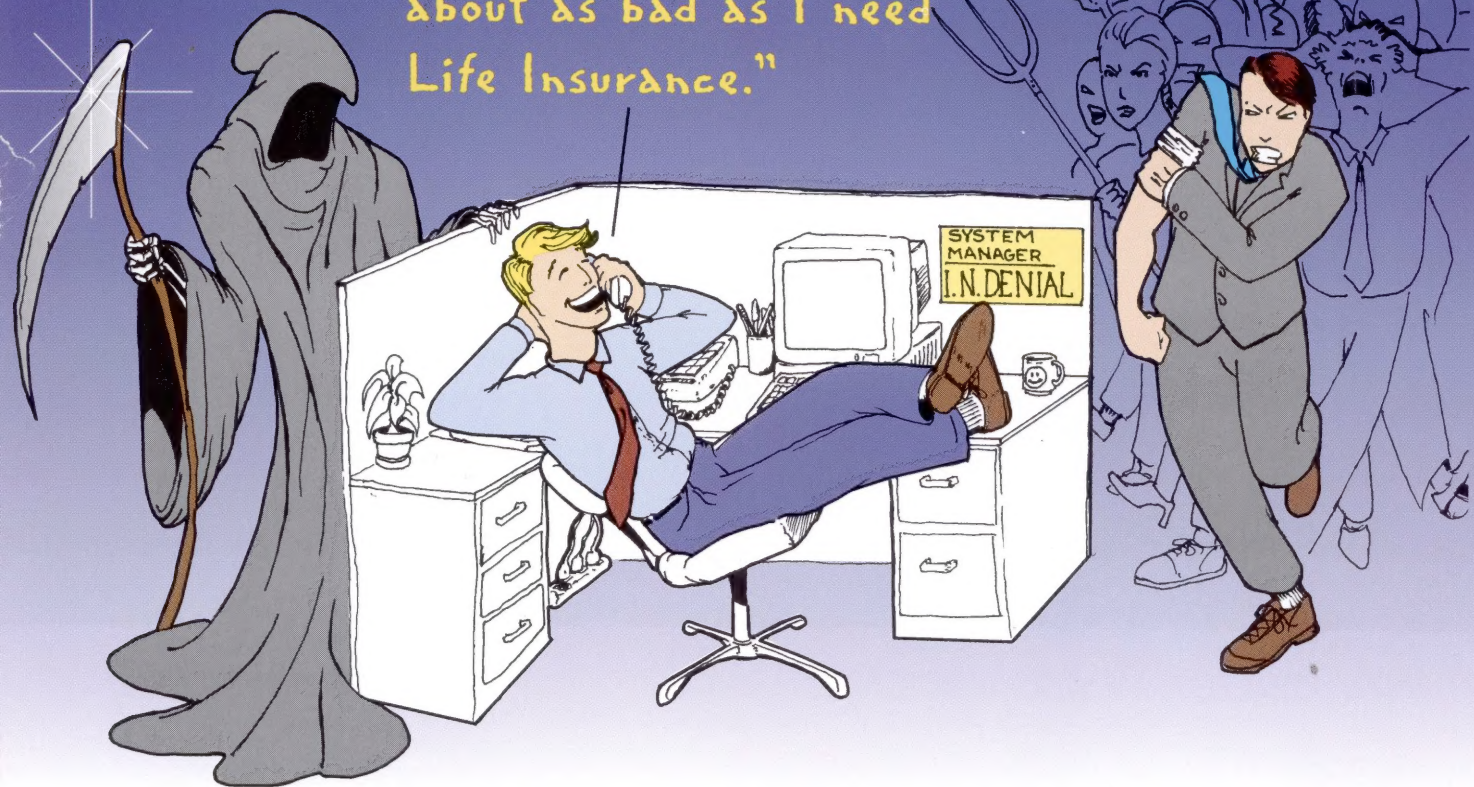
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